"THE INTEGRITY OF THE INDEPENDENT TELEPHONE SYSTEM AND ITS UNIVERSAL EXTENSION"

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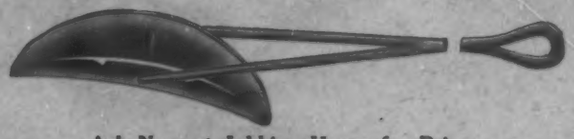

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Telephony.

VOL. XVI. SEPTEMBER, 1908. No. 3.

Independent Telephone Men

By R. G. Shelden

THE United States Telephone Company of Cleveland, Ohio, is undoubtedly one of the best managed properties in the Independent telephone field. Exclusively a long distance company operating under the laws of the state of Ohio, it has recently been incorporated also in Michigan with a capital stock of $50,000, to take care of its growing interests in that state.

The general manager of the United States Telephone Company is C. Y. McVey. Mr. McVey's first business experience was in September, 1891, when he became a teller in the Dollar Savings and Trust Company. His banking experience covered three years, terminating when, in 1894, he entered the offices of the Mahoning Valley Railway Company. Here he stayed for five years, his entrance into the telephone field dating from 1899.

The combination of financial and public service experience, as represented by Mr. McVey's banking and railroad connection, appears to form an excellent basis for the successful solution of telephone problems. At any rate, he went straight from the railroad to the general manager's desk of the Youngstown Telephone Company of Youngstown, Ohio. This position he held with marked success for six years.

C. Y. McVey.

The Federal Telephone Company of Cleveland soon noticed Mr. McVey's ability and in November, 1905, he was called to Cleveland, taking a position as assistant general manager of the Federal company. This company is now the owner of the Youngstown Telephone Company.

In the same month and year that the Federal Telephone Company appointed Mr. McVey assistant general manager he was made general manager of the United States Telephone Company. And in the following May, 1906, the Cuyahoga Telephone Company, which, together with the United States Telephone Company, is owned by the Federal Telephone Company, also appointed him general manager of its great properties.

Since that date, Mr. McVey has been elected president of the Columbiana County Telephone Company of Salem, Ohio; the Lancaster Telephone Company of Lancaster, Ohio; the Stark County Telephone Company of Canton, Ohio; the Youngstown Telephone Company; the Zanesville Telephone and Telegraph Company of Zanesville, Ohio; and vice president of the Citizens' Telephone and Message Company of Fostoria, Ohio, and the Findlay Home Telephone Company of Findlay, Ohio. These positions are still held by Mr. McVey.

Under his able management these telephone properties have prospered wonderfully. He is uncompromisingly Independent, and it goes without saying that the various telephone interests he represents are vigorous opponents of any and all competing Bell systems. Within the last few weeks the United States Telephone Company has obtained injunctions forbidding several of its connecting companies to make connections with Bell lines while under contract with the United States company.

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Editorial Department

THE NEW WEEKLY TELEPHONY.

BEGINNING Saturday, September 5, TELEPHONY will be issued weekly. The advantages of a weekly publication to the Independent telephone field have been apparent to the publishers for some time, and plans are now completed to give the Independent movement the best weekly medium possible. They have purchased the *American Telephone Journal,* which has been issued weekly in New York, consolidated it with TELEPHONY, and under the latter well known name will publish the most complete and valuable telephone paper the field has ever known.

Six months ago the *American Telephone Journal* absorbed *Sound Waves,* a monthly telephone paper published in Chicago. Since it was established nearly nine years ago TELEPHONY has absorbed two other journals, the *Telephone* and the *Telephone Magazine.* The net result of all these changes is that TELEPHONY, in its next issue, will embody no less than five telephone publications, which have flourished individually at various periods but now are assembled under the title of TELEPHONY, which, ever since its inception, has been synonymous with loyalty to the Independent telephone movement and the best development of the telephone industry generally.

Speaking familiarly, as face to face with our subscribers, we do not like to toss bouquets at ourselves too openly, but many of TELEPHONY'S friends have been good enough to tell us that this outcome was to be expected. That is to say, that it was the natural thing for other telephone journals to gravitate toward TELEPHONY which has always been recognized as the one staunch loyal Independent telephone paper that could be relied upon. The publishers have ever been proud of TELEPHONY'S popularity and good name in the field and have earnestly labored to maintain them. That they will continue to do so does not need assertion.

The crusade for Independent principles in the past has not always been an easy one, as other publishers of telephone papers can testify. The Bell telephone monopoly is a hard foe to fight. Like all trusts, it is ready to use its wealth and power relentlessly to accomplish its purposes. The means can be fair or foul so long as the result desired is attained. The Bell has tried to lure TELEPHONY away from strict adherence to the Independent cause by various means, recognizing the power of its influence in steadfastly opposing monopolistic tendencies. The fact that this publication has consistently refused to be swerved from its straightforward course undoubtedly had much to do with the condition herewith announced. That is to say, that the loyal support of its Independent friends has enabled TELEPHONY to absorb its former competitors and proceed along its even path of loyalty to the Independent cause and opposition to the Bell telephone monopoly and its methods.

And not only will the new TELEPHONY adhere to Independent principles, but it will give all its readers the best telephone paper that money and talent can supply. Being issued weekly the new paper will give all the important and latest news of the telephone field. The best technical writers obtainable will contribute to its pages, and the regular departments that have made TELEPHONY indispensable to telephone men in the past will be enlarged and improved. Franklin H. Reed, who has edited the *American Telephone Journal* so successfully for years, will head the new TELEPHONY editorial staff. More complete announcements of what will be done toward making the new consolidated weekly the best will be made later.

Of course, a larger subscription price must be charged for a weekly than for a monthly publication. No argument is required to prove that; it is a self-evident fact. The price of the new weekly will be $2 a year until January, 1909, when the rate will advance to $3 per year, and we venture the prediction that after scrutinizing a month's four issues of TELEPHONY few will candidly say the publication is not worth that price. Every fourth issue, coming at the time when the regular monthly TELEPHONY would appear, will be a special number as large as this present September issue. Those that have paid subscriptions either to TELEPHONY or the *American Telephone Journal,* or both will receive credit for that time at the new rate. For instance, the subscriber who had paid $2 for a year's subscription to the weekly *American Telephone Journal* will receive the new weekly TELEPHONY for the remainder of the time paid for. The subscriber who had paid $1 for a year's subscription to the monthly TELEPHONY was entitled to twelve issues and will be given credit for six months' subscription to the new weekly. The subscriber who had paid for annual subscriptions to both the *American Telephone Journal* and TELEPHONY will be given the new weekly a year and a half.

The publishers assure TELEPHONY'S many friends in the telephone field that it appreciates the support and good will they have manifested in the past and will earnestly strive to merit their continuance in the future. The success of the Independent telephone movement has always lain close to our hearts, and it is a matter of no little gratification that TELEPHONY is now able to render better service than ever in that direction. The new weekly respectfully asks for the support and co-operation that have made TELEPHONY the leading journal in the past and enabled it to do great things for the industry. All signs point to a wonderful era of telephone development in the years to come, and that same spirit of co-operation between TELEPHONY and the field is sure to bear fruit. Although the United States leads in telephone development the industry is still in its infancy and tremendous strides will be taken within the next decade. The telephone business is a good business, and is bound to be a better business. TELEPHONY has unbounded faith in the future of the industry and the ability and enterprise of the men who are big factors in it. They, it may be added, have alike demonstrated their confidence and trust in TELEPHONY in the past. It will be our endeavor to retain that confidence in the years that are to come, and after all works, not words, will tell the tale.

CONVENTION DATE SET.

ACCORDING to plans made by the executive committee, which met at Niagara Falls, August 15, the next national convention of the International Independent Telephone Association will be held at the Auditorium Hotel, Chicago, December 1, 2 and 3. This will bring two conven-

tions in the year 1908, but as the last was held in January, nearly a year will have elapsed before the association meets again. Plans are being formed to make this convention one of the most important and valuable ever held by the organization. Conditions in the telephone field are improving rapidly and the prospects are that by the time the delegates convene an era of prosperity will have begun equal to that which preceded the financial depression of a year ago.

During the past twelve months no class of corporations have demonstrated their inherent strength in hard times so thoroughly as have the Independent telephone companies all over the country. Not only have they maintained their place while many other industrial enterprises have been severely crippled, but they have in many cases shown a substantial gain over corresponding periods of last year when business activity was at its high mark. The feeling is general that the country is entering upon a period of good times. That the Independent field will profit by this change is considered certain.

Besides the usual work that comes before an annual meeting the convention will have to fill the vacancy caused by the resignation of A. C. Lindemuth from the presidency. The executive committee probably will not elect his successor, leaving that task to the convention. It is the purpose of the Independent leaders to put the telephone business on a firmer basis than ever, and those who attend the December meeting will receive reports calculated to make them proud of being identified with the International Independent Telephone Association.

BELL INSTRUMENTS INFERIOR.

THERE are still a few men in the telephone field who, living upon tradition and taking Bell advertising at its face value, hold the idea that Bell instruments are the *ne plus ultra*, the final word, in telephone manufacture. This is an excellent illustration of the power of advertising; for as a matter of fact no Independent manufacturer would dare to put such a product on the market as the Western Electric Company is now selling to those occasional gullible customers who oppose their fellow workers in the Independent field by giving aid and comfort to the enemy during a period of financial stringency.

But retribution has already overtaken these backsliders; for they have found that, taken away from the conditions under which they have been working and the supervision of men acquainted with their peculiarities the "genuine Bell" instruments are inferior to even the poorest of the Independent class, as the following letter from an inspector in a small community shows:

"I wonder why any one wants to use a Bell telephone when he can procure one of Independent make. The owner of this plant some time ago made a contract with the Bell for toll line connections and procured some fifteen or twenty instruments from the Western Electric Company; but the majority of the instruments used are of Independent make, and out of more than one hundred telephones those Bell instruments are in the repair shop more than all the rest put together. I actually did not realize the weakness of the Bell instruments until I came here where both are working together. I cannot enumerate all their faults, but here are a few:

"Packing in transmitter; we have no packing trouble worth mentioning except in those received from the Western Electric Company.

"Broken wires; the long arm with the induction coil in the base and its mass of wires up to the bell box, is a constant source of trouble caused by broken wires. Independents manufacture this style now only upon order, and by offering their customers the compact type give them a better, cheaper, neater and less troublesome form of instrument.

"Cut-outs; the cord conductor up the outside of the arm is not only unsightly but is frequently frayed or broken. Transmitter arm forms part of the circuit which makes annoying disturbances and cut-outs. In Independent instruments, two conductors, concealed within the arm where they cannot be injured, lead to the transmitter direct and the arm forms no part of the circuit, as Independents found out long ago that it was a frequent source of trouble, just as we find it a frequent source of trouble in the Bell instrument.

"The hook switch is also of an old style that Independents have discarded and is a frequent cause of trouble.

"Inaccessibility; when the induction coil gets in trouble, which is frequently the case, the entire arm has to be removed and the wires disconnected and it requires an experienced man to put them back again in their proper places.

"Receiver troubles; the Bell receiver having binding posts at the lower end, to which coil tips are secured, the cord is continually getting broken at this point. With Independent manufacturers both ends of the receiver cord are covered up and out of harm's way.

"Receiver diaphragm frequently gets down on magnets and the receiver is not as sensitive as many of those made by Independents.

"Receiver spools frequently have open wire troubles.

"Generators; the Western Electric generator sets are about the limit; made only for short line ringing, they are weak in current, have low voltage and are short lived as they burn out easily and are continually getting back to the repair room.

"In the construction of generators for party line ringing the Independent manufacturers are away ahead, as the poorest of their generators will ring bells clearly where the Western Electric generators will not make a sound. An Independent man could not sell generators as poor as these, or even give them away.

"In material the Western Electric Company uses no better than that used by other manufacturers and so far as the writer has been able to discover there are but two points in favor of Western Electric telephones and those are minor ones.

"Party line bells; ringer cores of large size, and long. This is probably an advantage in preventing leakage of voice currents by the greater amount of self-induction introduced. This, however, is a disputed point and bells made by Independents seem to give equally good results.

"Accurate machine work; parts are accurately machined so that every part fits into place without pressing, crowding, or squeezing. Accurate machine work is a very good point, but in this they are rivalled by some of the better class of Independent makes.

"In fact, the claim that Bell instruments are standard may be qualified by saying that they are standard only for Bell companies, and it would seem that standardization with them, spells stagnation; for with the exception of the two points noted above they are inferior in every other respect, and the writer cannot see that they have made any improvement in fifteen years, while the Independents are, by reason of competition and keen rivalry, forging ahead.

"I might add to the above, that in toll line work where we sometimes encounter poor lines, our Independent instruments stand up fully as well as the Bell or even better."

ULTIMATE TELEPHONY.

AS A THINKING animal, man is more or less given to predictions and forecasts. Perhaps it is the transitory nature of all human work that tends to tinge many of these forecasts with pessimism. The telephone business, wonderfully virile as its short history has proven it, is not exempt from the attacks of those gloomy prognosticators, happily few in number who argue that the telephone industry has reached the high-water mark; that the per capita ratio of telephones is now at a point where future increase can only be

based on a comparatively moderate rate of population increase; that there is no new remunerative field for the telephone; and that capital is bound in time to look askance at new telephone ventures. They even invade the especial province of the engineer with the statement that no real improvements are further possible in telephone apparatus.

The field of the telephone is the field of language itself. It is the physical tongue of the world. Not a man, woman or child lives but is a potential telephone subscriber. Not a word is ever uttered but is a potential telephone message. And conversation, as a human function, is primary. Man eats, and drinks, and sleeps of necessity; but first he talks.

In railroad train dispatching, in the telephoning to moving trains or cars, in the substitution or co-operation of telegraph and telephone, in constantly increasing long-distance communication and its antithesis, interior intercommunication, are the nucleuses of little developed fields that have their branches wherever man depends on man.

The present form of the telephone is quite satisfactory and convenient. But little imagination is needed to picture the telephone instrument of the future as requiring no receiver held to the ear, no adjustment of the lips to a transmitter mouthpiece. These parts will serve their functions efficiently, but unobtrusively—perhaps invisible to all but the user.

And so long as we are restricted to one or two thousand miles; so long as the submarine cable remains refractory to the transmission of voice currents; so long as the busiest telephone wire lies idle the greater part of the time, who will have the temerity to declare that the ultimate development of telephony has been attained, or that capital will not reap its harvest?

CONCERNING A SORE TOE.

IN its defense of the Independent telephone movement, TELEPHONY has found it necessary to call attention to the grossly unfair attacks—and equally unfair and fulsome praise of the Bell—which have been printed in a magazine called *Public Service*. As these attacks continued, the hand of the Bell press bureau became more and more apparent, until finally no doubt existed in Independent circles that *Public Service* bore a commission from the Bell monopoly to fight the Independent telephone companies. TELEPHONY has not failed to point out these developments and charge that the magazine in question was a Bell hireling.

The last issue of *Public Service* contained the appended editorial, which indicates that the shoe fits pretty tight and is not very comfortable. Thus is the sore toe exhibited:

> From time to time editorials appear in TELEPHONY, an organ of the Independent telephone interests, resenting the attitude taken by *Public Service* with reference to competition in public utilities, and attacking this magazine with epithet and abuse.
>
> There is no necessity for defense against these attacks, but we wish to point out that our position on competition in public service has been uniformly consistent. The view held by *Public Service* ever since it was started is that the supplying of gas, water, electricity, urban transportation and telephone service are natural monopolies, and as such are rightful and proper because they make for higher efficiency and lower costs to the public.
>
> We have printed from time to time a great deal of evidence and opinion to back up this contention, which is rapidly becoming a fundamental rule in the highest places where questions of the kind are decided. We are not aware that we have ever deviated from this principle in a single instance, and there is no reason why an exception should be made with reference to telephone service.
>
> It may be said that the magazine TELEPHONY owes its existence to telephone competition, and when telephone competition is terminated it also, doubtless, will terminate. In view of this it is only natural that TELEPHONY should show its teeth and snarl whenever the "interests" upon which it depends for revenue are inspected or their methods criticized.

TELEPHONY cheerfully concedes that it "owes its existence to telephone competition," for it was the public demand for competition and a chance to get away from the grasping monopoly of the Bell that led to the establishment of the Independent telephone movement. The undoubted hope of *Public Service* that "telephone competition be terminated," however, will not be realized. The Bell, of course, entertains the same hope, and for many years has been working by fair means and foul to accomplish that end. That is why *Public Service* echoes the same wish and is doing all it can to attain the end for which all allies of the Bell press bureau have been slavishly striving. It is simply a case of re-echoing, parrot-like, its "master's voice."

TELEPHONY has no quarrel with the right of any publication that honestly believes it to advocate the theory that telephone competition is a mistake. The journal that pretends to deal fairly with the question, but confines its efforts to malicious attacks on Independent securities and methods and fawning praise of the Bell trust, however, is plainly not in that class. The editorial quoted above mentions five public utilities, telephones being only one. The fact that the only subject referred to in *Public Service* with never-varying hostility and biased criticism is Independent telephony is strong proof that its editor holds a brief for the Bell telephone monopoly and that nothing impartial can be expected from him. This is further borne out by the fact that all his information and arguments bear the well known Bell trademark. To use a common expression, it is Bell "dope" from first to last. If *Public Service* owes its existence to the corporation monopolies no doubt it is justified in printing that sort of stuff, but it certainly has no right to pose as a fair critic of Independent telephone companies.

TELEPHONY has no fear the day will ever come when there will be no telephone competition. The time is likely to arrive when the Bell system will be universally acknowledged a bad second to the Independents in the race for telephone supremacy, but even then there is sure to be keen competition. The people have had enough of oppressive trusts of the Bell stripe, and will see to it that they do not again gain the upper hand.

It is not amiss to add that no doubt the Bell will apply a soothing lotion to the sore toe above referred to, and that the abuse of Independent telephone companies will continue.

MORE BELL PRESS BUREAU WORK.

CONCLUSIVE proof that the Bell combine is pursuing its long established malicious tactics in seeking to undermine Independent securities and destroy Independent credit is found in a letter being sent broadcast throughout the state of Michigan. This letter is mailed to bankers and prospective investors in Independent securities by a division manager of the Michigan State (Bell) Telephone Company and reads as follows:

"Dear Sir:

"The Boston News Bureau, one of the most reliable and authoritative financial papers in the country, has published on August 6th an interesting and thorough article on the financial instability of independent telephone companies, and I am herewith enclosing a copy of this issue for your own personal information. The writer believing that you may become interested in different securities, and in telephone securities, this article is particularly worthy of every investor's attention."

Enclosed in the letter was a clipping alleged to have been taken from the Boston News Bureau, entitled, "The Independent Telephone Collapse. The Logical Result of Over-Capitalization, Insufficient Maintenance and Loss of Financial Credit," which was a characteristic blast against the Independent telephone industry.

These bushwhacking letters recently have been mailed to prominent business men in the Saginaw Valley, where the Saginaw Valley Telephone Company, a strong independent concern, is operating and rapidly developing. This company was built with capital subscribed by the people of Saginaw and the surrounding territory, including 400 stockholders. During the last year the company has expended

$185,000 in enlarging and improving its Saginaw city exchange. No doubt the Bell attack was for the purpose of discouraging the Saginaw company's stockholders and making it trouble. The reason of course is that the Saginaw Independent concern has cut into Bell business and given the octopus more competition than it cares for.

The incident simply shows that the Bell combine is up to its old tricks, and that all the talk about a pacific policy being adopted is all buncombe. The Bell is just as determined to undermine the Independents as ever by fair or foul means; and that foul means is still its favorite weapon is clearly demonstrated by the above letter.

An official statement from the International association touching on this article in the Boston News Bureau has just been sent out by Secretary Ware and follows:

During very recent years it has been found quite effective for large corporate interests to enter upon a systematic effort to educate the public upon matters particularly pertaining to special features of the business, or, by diverting the public mind along certain selected lines, obtain a cessation of threatened exposure in other directions.

For the purpose of conducting this character of campaign in the public press, publicity bureaus, with specially trained corps of writers have been organized and undertake for a given sum to secure favorable support to the desired cause, through interesting and commendatory articles in leading magazines, newspapers and journals and also especially strong editorial articles therein and thereon and usually all these are *paid for at per line rates!*

Some time ago the Bell telephone interests after negotiations with certain publicity bureaus appropriated $200,000 to be expended in trying to convince the people of this country that competition in the telephone business is an economic waste, (as it is in all lines of business!) and therefore should be eliminated (though everybody knows that high rates and poorer service would result); and further asserting that the Bell competition had not succeeded, "overcapitalization, insufficient maintenance and loss of financial credit," being the cause given for the collapse of such movement!

From the point of historical accuracy, present conditions and growth, and the almost universal prosperity of the Independent companies in all parts of the country, the average reader is astounded that supposedly reputable journals and newspapers in the large cities should print as editorial matter or news articles, even for pay, so maliciously false and grossly inaccurate an article as that recently appearing in the *Boston News Bureau* under the caption "Independent Telephone Collapse." For years it has been recognized that the *Boston News Bureau* was controlled by the Bell interests and that large allowances were necessary in any telephone matter it published. However, not only was and is that article, claiming the downfall of the Independent telephone movement reprinted for pay as suggested, but the agents and official employes of the Bell companies are mailing copies to bankers and those directly interested in stock and bond propositions, thus endeavoring to destroy a market for Independent telephone securities, and thus retard the continued progress being everywhere made by the Independent interests.

In rapidity and permanency of development, in immediate and beneficial results to the public therefrom, there is in the whole realm of business nothing that approaches in comparison with the success and achievement of the Independent companies.

Within ten years they have furnished four million subscribers good telephone service, of which ninety per cent have no other; they have revolutionized the business, and so simplified and improved the service that today it is the rule to find a satisfactory Independent service, and a greatly improved Bell service. They have secured to the public this manifold enlarged service, both in quantity and in quality, and at rates everywhere more reasonable than before competition.

Twelve years ago in the United States there were fewer than 400,000 subscribers' telephones, and after twenty years of Bell supremacy and monopoly; now there are over seven million telephones in service, of which there are twenty per cent more Independent than Bell telephones in use.

Take the telephonic conditions in Ohio, Indiana and Illinois, being mostly included in the territory occupied by the Bell company's licensee known as the Central Union Telephone Company (Bell 76.76 per cent). In this territory is the following:

The Central Union Company has 200,000 subscribers. The Independent companies 630,000.

Central Union floating indebtedness over sixteen million dollars.

Independent companies, less than six million dollars.

Central Union dividends in twelve years, none.

Independent, as a rule prosperous and paying.

For over ten years the Independents in this section have grown regularly and faster than the Bell's Central Union; the latter has by competition been forced to abandon a score of cities and towns in its territory and can maintain its position, even as a good second, only by alliances with some of the smaller and weaker Independent companies and by doing business in many places without profit.

There are over 12,000 Independent telephone companies in the United States (see TELEPHONY's list) as a rule locally owned and managed; in no other line of business have there been proportionately so few failures—but a fraction of the number of annual bank failures, and the losses to telephone investors have been but a fraction, proportionately to the losses annually through bank failures. All the losses to investors by reason of failures, directly and indirectly, among the Independent companies aggregate less than the one Bell receivership in Michigan (Michigan Telephone Company—now Michigan State Telephone Company). In over ninety per cent of the Independent companies the average cost and also investment per telephone is materially less than with the competing Bell company, correspondingly; the average floating indebtedness of the Independent is relatively less than one-third as a rule than that of the competing Bell company, and generally the credit of the local telephone companies is very high.

No other business has suffered less during the past months of unusual depression than the telephone, and it must be admitted the Independents have as a rule been apparently less adversely affected than their competitors, the Bell companies, which, however, made excellent showings through the hard times period.

Apparently, to the writer, the remarkable and erratic course being pursued by the Bell in its scurrilous attack and dishonestly misleading statement, taken as a whole, relating to the Bell competitor, is an emergency brought upon the Bell by its own peculiar policy during the last decade—that of undertaking to prevent capital being invested in Independent plants by means of planned misrepresentation and exaggeration. The result has been the Bell interests have frightened the banking and trust companies to that extent that in all our country the circle of area where Bell securities would sell has gradually narrowed and contracted until for three years past, outside of Wall street and New England, no Bell sales could be made as a rule. On the other hand, the Independents generally have been local companies, using only local money. As plants have grown, the facts and conditions being known, additional local capital has been and will continue to be secured, although not a dollar could have been obtained by a foreign owned corporation, such as is practically every Bell licensee company. But more than yet stated is, perhaps, found the reason for their present effort to discredit Independent securities, in that Independent companies, having already obtained franchises, are perfecting financial plans to put modern telephone exchanges in Boston and Milwaukee. It does not take a financial genius to recognize that the building of Boston by the Independents would not only in all probability close the market in that section to the sale of Bell securities, but would perhaps influence New York City officials to grant the franchise so long sought and now pending for an Independent telephone company in the nation's metropolis.

The building of Milwaukee would unquestionably result in the loss of Wisconsin to the Bell, and undoubtedly have a tremendous influence on the Chicago situation. Few exclusively Bell telephone cities are left, and with these mentioned lost to them, one hesitates to forecast the probable result. If by the expenditure of $200,000, whether by publicity true or false, the Bell can somewhat retard the coming events, from their standpoint the expenditure will be warranted.

But, at best, it means only delay. Never again will there be monopoly of the telephone business of the large majority of the exchanges of our land; never can the people's dominating interests be eliminated. The Independent manufacturers make better telephones, and better and more modern apparatus than manufactured by the Bell factory—the Western Electric Company.

Many more thousands of stockholders are in the Independent, than the thirty-five Bell companies, and many more hundred thousands of true American citizens are in sympathy with local interests more than with foreign, and no sane man, acquainted with conditions, but realizes that the control of the telephone and its financing rests with the people more often and surely than with citizens in Wall street and in Milk street.

Soon will be determined whether in the telephone business honesty pays; and also, again, whether the Bell interests will be able "to fool all the people" as to its theory of the business, and also put that theory into practice. The writer believes the people can be depended upon to preserve their own best telephone interests.

OPPORTUNITIES.

TELEPHONY'S Daily Report to advertisers has listed, since the first of the year, over three thousand new incorporations, increases of capital stock, and proposed construction items in the Independent telephone field. Those dealers who complain of hard times protest that these companies are not ordering anything. What a tremendous purchasing power, then, is being held in reserve; and what a scramble there will be among those dealers who are not prepared, when that power is released!

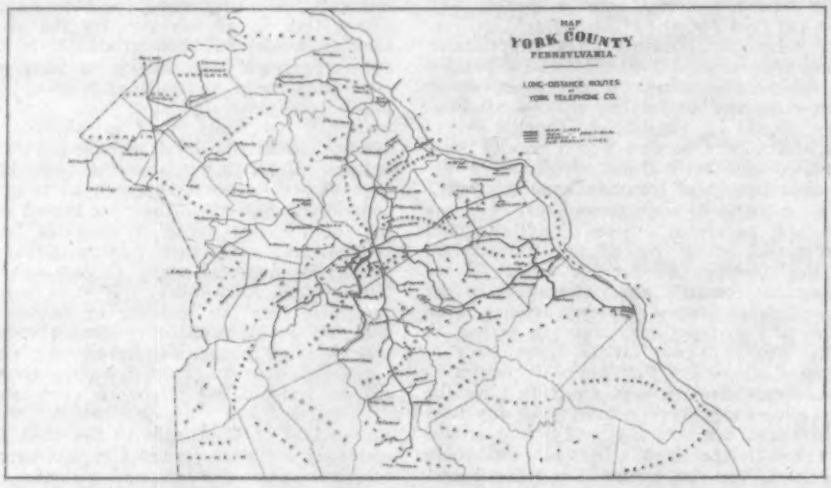
THE YORK TELEPHONE COMPANY

An Enterprising Independent Company and Its New Plant

By J. C. Ames

THE York Telephone and Telegraph Company was organized in 1895, but did not begin operation until the following year. Its original exchange was situated in the Rupp building, on one of the principal streets of York, Pennsylvania, and was equipped for three hundred telephones at the outset. The system used was that known as the McCluer system, based on an arrangement invented by C. E. McCluer of Richmond, Virginia. The theory of this arrangement consisted merely in the substitution of a common return wire for the ground return usually employed at that time. It was found that by making the common return wire from fifteen to twenty times the cross section of the talking wires practically all cross talk and extraneous noises were eliminated.

This system was very satisfactory and gave excellent service while the capacity of the exchange remained at a limited figure. But the exchange grew, as exchanges will that give satisfactory service at reasonable rates; and the rapid encroachments of electric traction enterprises and alternating current lighting systems made some change in the telephone plant imperative. So in the year 1898, just two years from its inception, the York Telephone and Telegraph Company's system was changed to full metallic wiring throughout, and at the same time greatly enlarged, its capacity being more than doubled.



Map showing the county lines of the York Telephone and Telegraph Company.

In 1900 the exchange was again in need of space, and it was moved to quarters in the Electric building. This building is now the Colonial Hotel. By this time the management of the company had realized the possibilities for growth in a city the size of York, and planned to equip the new exchange for all possible future increases. Arrangements were made for an immediate capacity of 1,400 subscribers.

In 1905 new equipment was purchased, capable of handling three thousand lines. And to operate this extensive system of telephones satisfactorily the old magneto apparatus was thrown out and a complete common battery installation took its place. This equipment was furnished and installed by the American Electric Telephone Company of Chicago.

In May, 1908, this exchange was vacated; and the present home of the York Telephone and Telegraph Company in its new modern, fireproof building, is shown in the illustrations. The list of telephone subscribers at this time numbers over 3,500.

The company has in use in the city of York about eighteen miles of cable. This cable varies from the three hundred pair size, containing over six hundred separate wires, down to the smallest fifteen pair cable. Then there is a cable across the Susquehanna river from Wrightsville, York county, to Columbia, Lancaster county. The river at this point is over a mile wide.

The York Telephone and Telegraph Company operates six exchanges—the main office at York, and branches at Dallastown, Dillsburg, Wrightsville, Shrewsbury and Stewartstown, all in York county. The company's toll connections are too extensive to enumerate.

The York company was organized under the laws of the state of Pennsylvania, and enjoys a perpetual charter. The charter covers practically the entire state, allowing for unlimited growth without interference or interruption. The

Your Company's office building.

York Company's exchange building.

three hundred miles of pole line now owned by the company covers nearly the entire county of York. Of an authorized capital stock of $500,000, the books show $200,000 outstanding. The company is authorized to issue five per cent bonds to the amount of $2,000,000. The actual issue outstanding is $242,500.

The York Telephone and Telegraph Company has connections with the following Independent telephone companies: the Keystone State Telephone and Telegraph Company of Philadelphia; the American Union Telephone Company of Harrisburg; the Columbia Telephone Company of Columbia, Pa.; the Lancaster Telephone Company; the Lebanon Telephone Company; the Hanover Telephone Company; the Adams County Telephone Company; the Cumberland Valley Telephone Company; the Baltimore and Bel Air Tele-

York Company's main operating room and switchboard.

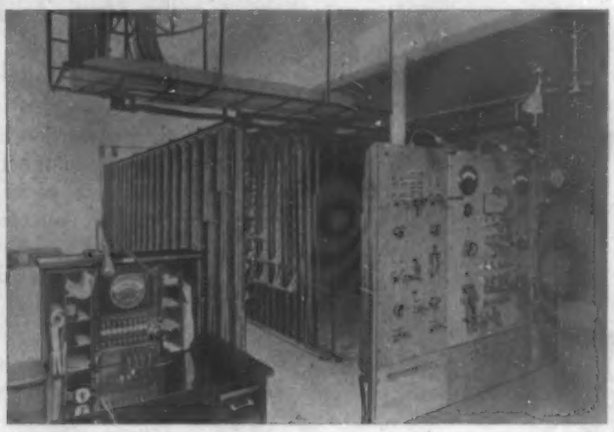
phone Company; the Inter-State Telephone Company; the United Telephone Company, and others. The rates charged vary from $12 to $48 per annum.

The employes of the York company number fully eighty-five. Of this number forty-five are operators. The board of directors is comprised of John McCoy, George B. Rudy, H. S. Wiest, Dr. William S. Eisenhart, and the officers, C. C. Frick, president; D. F. Lafean, vice president, and H. H. Weber, secretary and treasurer. The operating force is represented by G. B. Rudy, general manager; H. L. McNeal, superintendent; C. C. Coble, superintendent of construction; F. E. Kyle, wire chief; A. W. Yohe, cashier; D. Seitz, testing department; F. K. Porter, cable department; and D. G. M. Wallick, installing department.

The illustrations presented here hardly do justice to the

Long distance room and toll board.

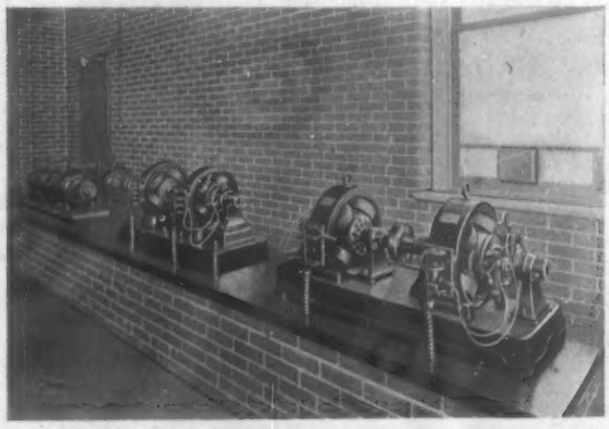
splendid modern fireproof building which has but recently become the home of the York Telephone and Telegraph Company. As may be seen, the office building occupies a position directly in front of the exchange building. The general office and accounting department is arranged to enhance the convenience of handling multitudinous accounts in every possible way, and is equipped with a handsome cashier's and bookkeeper's cage. The general manager's



View of terminal room.

office is neatly and appropriately furnished for its purpose, and conveys an impression of hard work. The directors' room, with its long table and comfortable but uncompromisingly business-like chairs, suggest long sessions with many a problem engendered by the typical Independent rapidity of growth which the company has enjoyed. Then there is the superintendent's office with its flat top desk covered with blue-prints and drawings, tee-squares and pencils.

The elegant mahogany switchboard has an ultimate ca-



The York Company's machines in terminal room.

pacity for twenty thousand subscribers. There is no cabling visible in the operating room, nor cable boxes other than the cable turning section at the left hand end of the switchboard. Through this section the great mass of cables which runs through the back of the switchboard is turned about and descends through the floor into the terminal room directly below. There the cables are carried on an iron rack to the different frames and distributed. The intermediate distributing frame and the relay rack match the switchboard in that they are equipped for 120 lines per position, thus making very simple cabling between these frames and the main board.

The long distance or toll room is equipped with a two position mahogany toll board of the most modern type, also manufactured by the American Electric Telephone Company of Chicago.

Taken all in all, the new home of the York Telephone and Telegraph Company, as well as its steady growth and its excellent service, are typical of the enterprising Independent telephone company.

CONDUIT AND MANHOLE CONSTRUCTION

A Description of New Methods and Designs Adopted in Telephone Work

By Clarence Mayer

THE improved designs of telephone conduits and manholes and the new construction methods explained in this article have recently been adopted by certain telephone companies with the object of reducing cost of construction or improving structures. While comparatively slight, still they are changes from the standard specifications in use throughout the country, and these changes represent the work of prominent telephone engineers who are always studying methods for improvements.

The following specifications, together with the drawings, are intended to supplement each other so that any details in one and not in the other shall be considered the same as if indicated in both. Only such parts of the specifications are given as relate to new methods or new designs, and it is not intended that the specifications and drawings shown in this article be complete instructions for the work of building underground conduits and manholes.

Method of Laying Vitrified Clay Tile.—The ducts should always be laid in a straight line, and where the trench is curved the

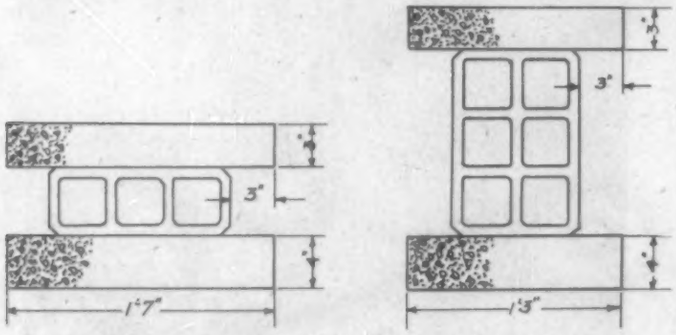


Figure 1. Sections showing standard conduit construction.

ducts should be continued in an even curve, avoiding at any point along the section any unnecessary bowing of the conduit.

The ducts should enter the manhole so as to leave a minimum clearance of ten inches between the bottom of the lower ducts and the floor of the vault. Where a large number of ducts are brought into a vault in several vertical rows, these rows may, where practicable, be spread out at the entrance so that some space is permitted between them.

All joints in the tile shall be broken or staggered. In joining two, three and six duct sections, use at least two dowel pins for each joint and also two pins in joining four duct in case the tile is designed for more than one.

For the purpose of adjusting the length of vitrified clay ducts terminating in manholes or buildings, a sufficient number of short pieces of duct of varying lengths shall be used.

In dumping concrete in the trench and in laying the conduit, care shall be taken not to knock off earth onto unfinished concrete work.

Standard Construction.—In standard form of construction a four-inch foundation of concrete shall first be laid which will extend three inches beyond the outer walls of the conduit.

The pieces shall be carefully butted and centered and shall be aligned by dowel pins, using at least two pins at each point. Each joint shall be protected by a strip of muslin or burlap which shall smoothly extend over the end of each section of conduit at least three inches on each side of the joints and shall lap at the top for at least six inches. This muslin or other cloth shall first be thoroughly soaked in water, then laid out flat, and to it shall be applied a thin coating of neat Portland cement paste. The muslin or other cloth shall then be placed around the joint in the tile as described. After the joint has been thus made the entire surface of the muslin or other cloth shall be covered with a three-eighths-inch layer of mortar not leaner than one part Portland cement and one part sand.

After the required number of ducts have been laid and jointed and the joints set, the sides of the trench shall be filled with thoroughly tamped earth to a height level with the top of the upper tier of ducts. A layer of concrete three inches in thickness shall then

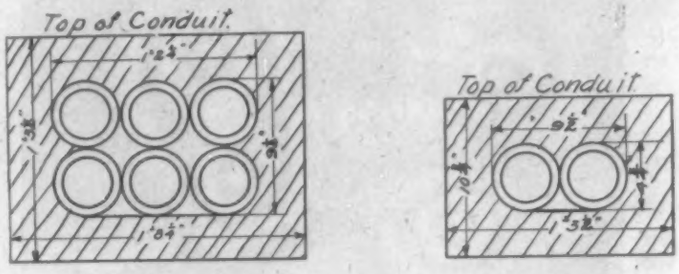


Figure 2. Sections showing class "B" conduit construction.

be placed over the ducts extending three inches on each side beyond the outside line of the ducts. The method of construction is shown by Figure 1.

Class "B" Construction.—This construction may be used if the special conditions present warrant it. Class "B," that is, a complete encasement of ducts in concrete, is advisable where quicksand or other wet places are encountered, to prevent the infiltration of silt. In such construction the ducts are entirely surrounded with a concrete encasement three inches thick.

The joints of the tile shall be wrapped with burlap or other approved material, which shall extend at least three inches each side of the joint, and shall overlap at the top at least six inches. If the conduit is of large cross section, it shall be built up in tiers.

Re-enforcing Concrete.—When straight concrete in the trench does not afford the required strength, either in standard or class "B" construction, the concrete base, top, or sides shall be re-enforced by twisted steel wire, laid longitudinally.

Method of Laying Stone Conduit.—The trench shall first be prepared with a foundation of three inches of concrete well leveled

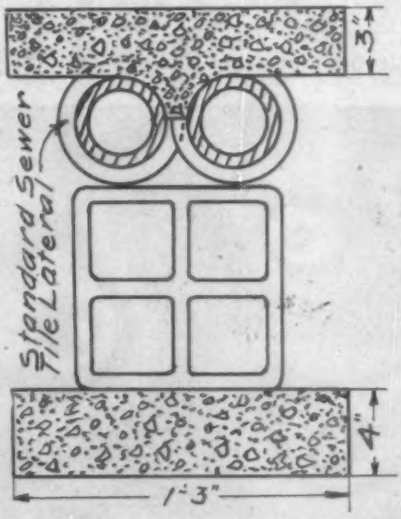


Figure 3. Section showing arrangement of main and lateral conduit.

and tamped. Upon this the stone conduit shall be laid and well settled into place. Care shall be taken to see that the lengths butt solidly together within the aligning collar. When two or more ducts are laid side by side, all joints shall be broken or staggered. When the ducts are laid they are to be enclosed at sides and top with a

wall of concrete three inches thick, well tamped into place. The conduit shall be thoroughly wet before being laid, so as to insure the joining of the surrounding concrete to the conduit. If the conduit is of large cross section it shall be built up in tiers. The formation shall be built up to its completed size and retained in position by clamps until concrete is installed. The clamps shall then be removed.

The desirable formation of the conduit for different cross sections shall be that shown in Figure 2.

Laterals.—Laterals when laid in main trench or in a separate trench shall be three-inch sewer tile, except as hereinafter specified, or at particular locations where iron pipe is advisable. Connection between the lateral laid in the main trench and the lateral laid in a separate trench shall be made of standard bends of sewer tile.

For laterals laid in separate trench, the trench should be wide

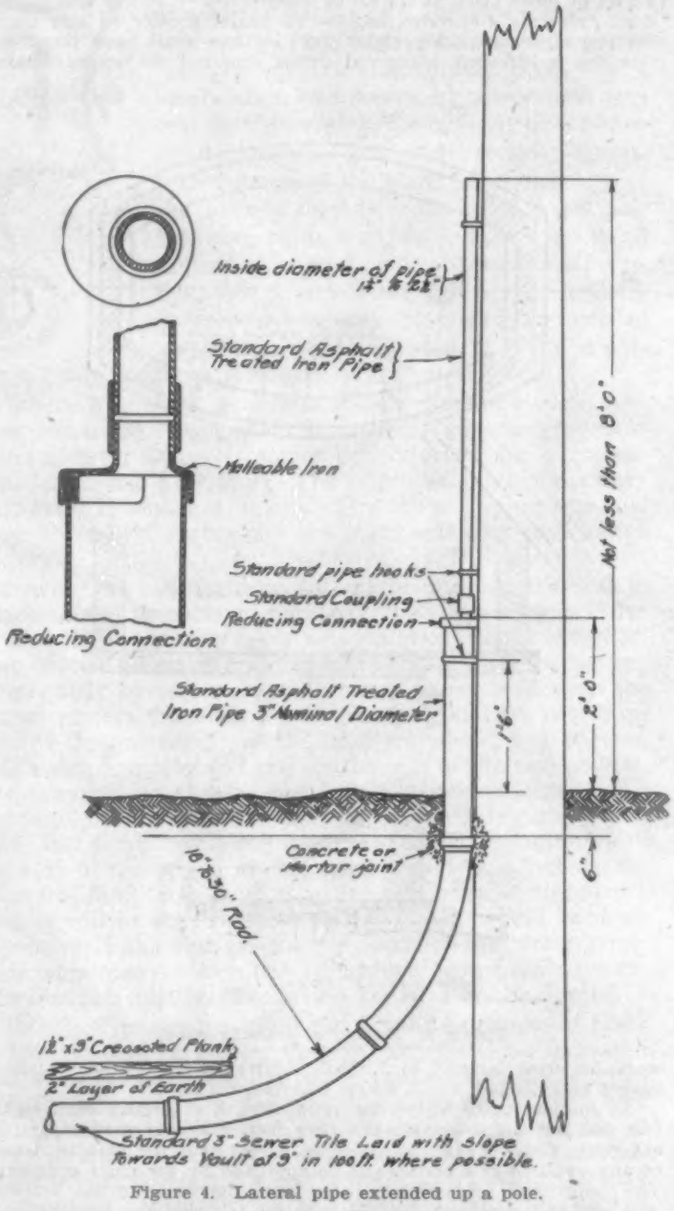

Inside diameter of pipe 1½" & 2½"
Standard Asphalt Treated Iron Pipe
Malleable Iron
Standard pipe hooks
Standard Coupling
Reducing Connection
Reducing Connection
Standard Asphalt Treated Iron Pipe 3" Nominal Diameter
Not less than 8'0"
2'0"
1'6"
6"
Concrete or Mortar joint
16" R. 30" Rad.
12"x3" Creosoted Plank
2" Layer of Earth
Standard 3" Sewer Tile Laid with Slope Towards Vault of 3" in 100 ft. where possible.

Figure 4. Lateral pipe extended up a pole.

enough to permit of practicable laying and deep enough to make the complete lateral with its protecting shelf of plank at least eighteen inches below the surface of the street. Joints of lateral laid in separate trench shall be well protected with cement mortar or concrete.

Over the lateral when laid in separate trench shall be placed about two inches of earth well tamped and on top of this a creosoted plank one and one-half inches by nine inches to prevent injury in subsequent excavations. Where laterals cross streets in separate trench, they may, if considered necessary, be protected by a surrounding cover of concrete.

Where one or two laterals are laid for a considerable distance in the main trench, three-inch sewer tile or vitrified clay duct may be used. If the duct is used, the joints between it and the pipe bend at the joint where the lateral leaves the main trench should be carefully made

When laterals are laid in the main trench, during the construction of the main conduit, they shall be placed at the top of the conduit formation and beneath the upper layer of concrete. (Figure 3.)

Laterals shall be extended up a pole by means of standard curves,

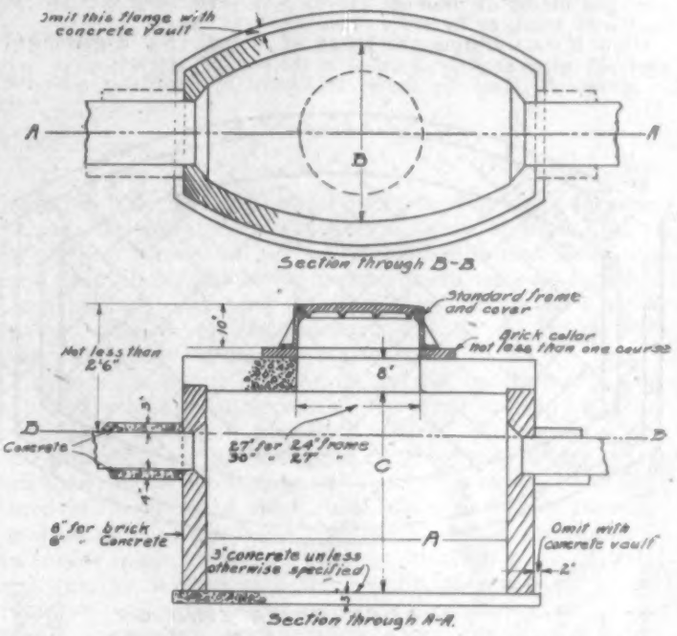


Figure 5. Construction of vault for straight run of conduit.

the extension on the pole itself to be made with iron pipe joined to the curve at the bottom with an approved reducer attached to a short piece of three-inch iron pipe. The joint between the curve and iron pipe shall be wrapped with burlap to prevent the concrete from

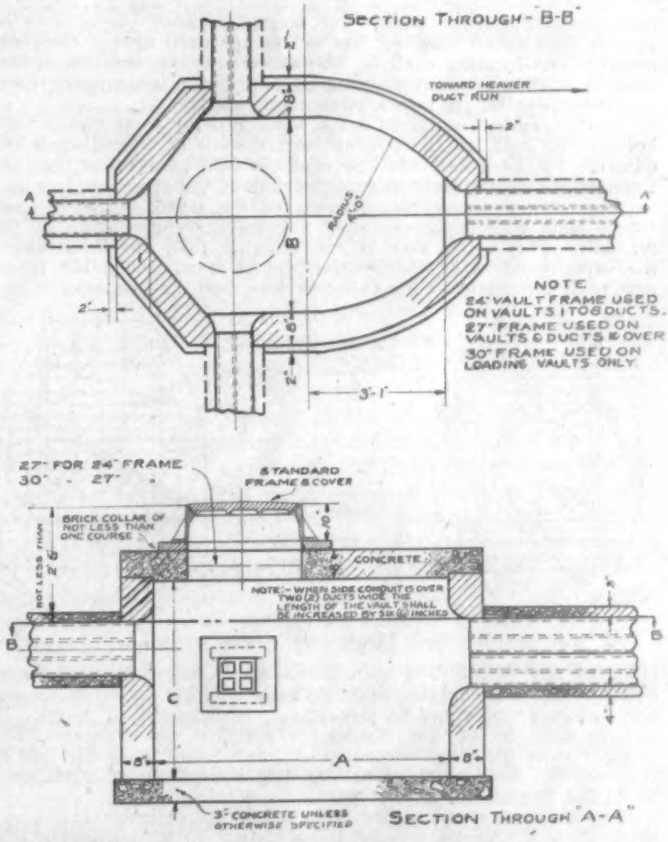


Figure 6. Construction of vault for conduit intersections.

getting into the interior of the pipe. The method of extending the lateral up a pole is shown in Figure 4.

Laterals shall have a slope toward the vault and where laid in separate trench, this slope shall not be less than nine inches in

one hundred feet, and greater where possible, and shall have no pockets or depressions in which water can accumulate. If conditions prevent giving lateral specified slope, it should be sloped in accordance with the directions of the superintendent of construction, and means of drainage provided by perforating the duct at its lowest point, or by some other approved device.

Fish Wires.—During the laying of laterals, No. 9 galvanized steel fish wires shall be installed as the work progresses.

Manholes.—Manholes should be located in accordance with the

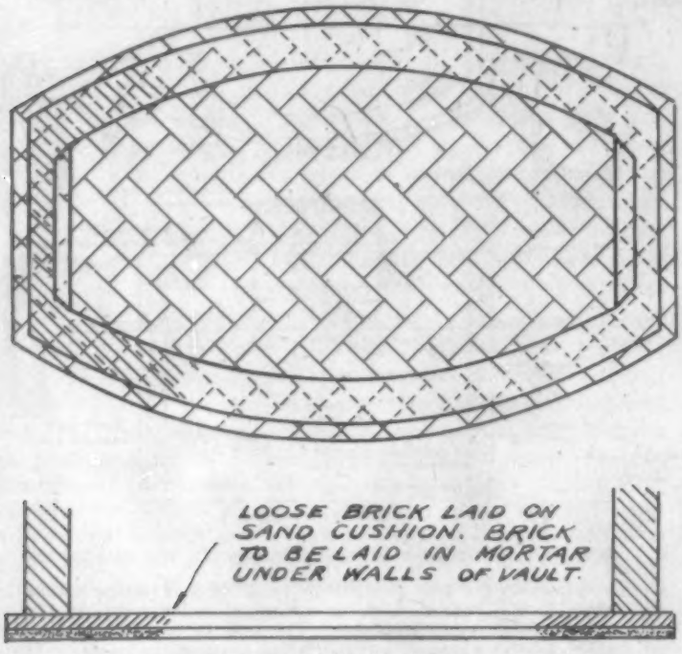


Figure 7. Brick vault floor.

plan provided for the work. No section between vaults is to be greater than seven hundred feet unless approved by the chief engineer. The location shall be barricaded and the excavation then made to such a depth as to bring the top of the subsequently mentioned brick collar ten inches below street grade.

On all vaults a collar of brick work at least eight inches wide horizontally and laid in cement mortar shall be placed upon the concrete top as a seat for the manhole frame, in order that the slope of the cover shall conform to that of the street surface and to allow for a reasonable lowering of the street grade at some future time without necessitating expensive reconstruction of the manhole. This collar may be made higher than one brick where the superintendent of construction deems it advisable, but in no case shall the height of the collar be less than the thickness of one

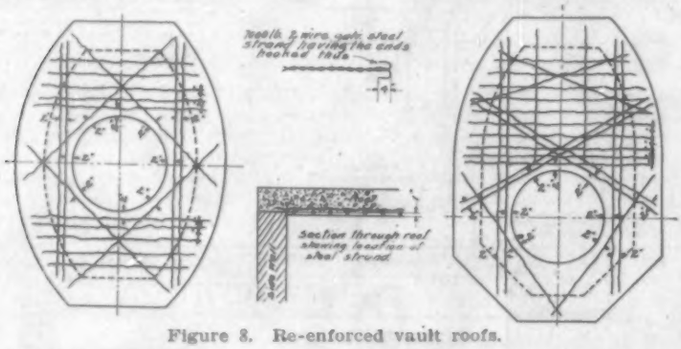


Figure 8. Re-enforced vault roofs.

brick at any point. The standard manhole or vault shall be of either brick with concrete floor, concrete top and cast iron frame and cover, or of concrete throughout, with cast iron frame. In size it shall be of the dimensions specified on drawings. For straight runs the long dimension of vault shall be in the line of the conduit. For intersections the long dimensions of vault shall be in the line of the heavier run.

For different cross sections of conduit the desirable forms and dimensions for vaults will be those shown on accompanying diagrams, Figures 5 and 6.

Vault Tops.—When the walls of the vault are finished and filled in around the inside, the wood form for the concrete top shall be placed. The form for walls and roof shall be thoroughly clean and wet before using. Moist sand shall be packed in along the intersection of the form for the top and the form for the neck opening in such a manner as to leave a rounded edge of the opening of approximately one and one-half-inch radius. The form shall be laid up so as to make the center of the manhole opening as nearly as possible over the center line of the ducts, going both ways, and midway between the ends of the vault.

Upon this form shall be placed a layer of concrete of the necessary thickness as shown on the vault drawing. When this has been smoothly leveled and topped, the brick collar, previously mentioned, shall be built and the cast iron frame carefully set upon the collar in a bed of cement mortar. Care shall be exercised that the top of the frame as finally placed shall conform to the street grade.

Vault Floors.—Where a concrete floor is used, it should be three inches thick. Where the soil is sandy and well drained, concrete floors may be omitted entirely or floors may be made of cinders or loose brick as shown by Figure 7.

Re-enforcing Concrete Roofs.—All vaults greater in size than that provided for taking eight ducts or less shall have the concrete top re-enforced, using old strand removed on reconstruction

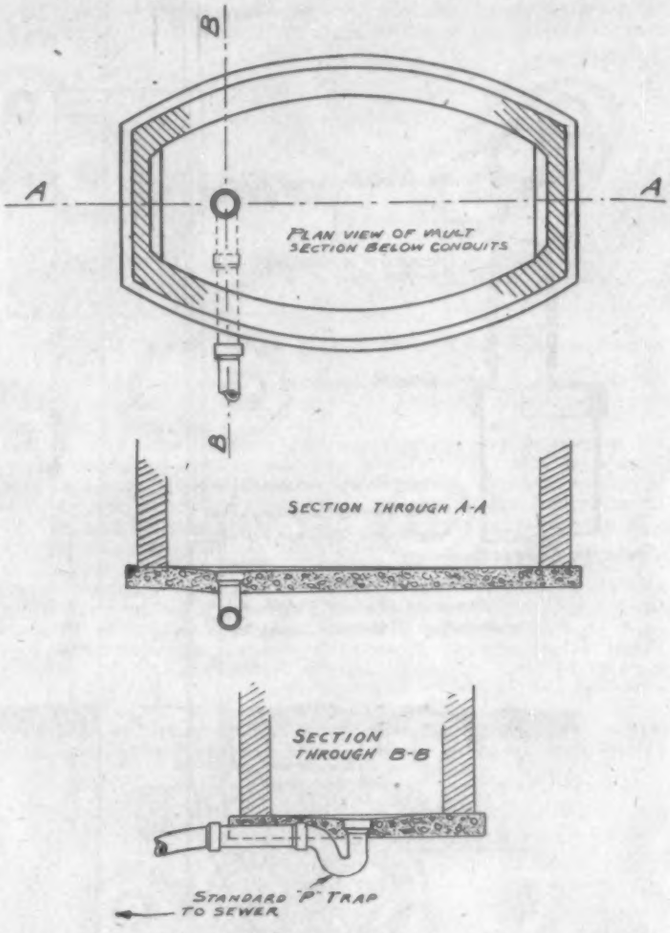


Figure 9. Method of draining vaults.

work or using lengths of 7,000-lb. 2-wire galvanized steel strand having ends locked, as shown on diagram, Figure 8.

In special vaults where the inside length is greater than eight feet and the width greater than five feet, a similar method of re-enforcing the top shall be followed except that the plan in detail of any vault in this class shall be approved by the chief engineer. The vault shall be kept barricaded until the concrete has become well set, and the form for the concrete top shall be left in place for at least one week, where the vault is exposed to heavy traffic.

Drainage.—Where an adequate sewer is nearby and connection can be made, all vaults shall be drained by a six-inch sewer "P" trap in bottom of vault with six-inch tile connection to the sewer. Where such sewer is not available and soil will afford natural drainage, one length of six-inch sewer tile should be placed perpendicularly in the ground from the bottom of the vault. All drainage openings shall be provided with cast iron strainers set flush with the floor of vault. Where a future connection to a sewer is contemplated a standard "P" trap, together with sufficient six-inch sewer tile to project horizontally beyond the bottom of the vault, may be installed when the vault is built. The outer end of the tile should be properly closed. The sewer opening should not be placed directly under the vault cover, but preferably at the side or near a corner. The method of draining vaults is shown in Figure 9.

POWER FOR TELEPHONE EXCHANGES

A Discussion of the Comparative Expense and Efficiency of Gas and Electric Power in Exchange Work

By Theodore Dimon

IN providing for that most important requisite in the design of a telephone exchange, continuity of operation, the source of power requires very careful consideration. In a small office, one source of power with several days' reserve in the capacity of the storage battery may give ample security against a shut-down of the plant. The capacity of the battery may be reduced if a portable charging outfit is available at not too great a distance. In an office of considerable size, however, it is imperative that two entirely independent sources of power be installed and maintained at all times, in so far as possible, ready for immediate use.

Where it is possible to obtain both gas and electric current, the usual arrangement is to install for charging purposes a direct connected motor generator set and a gas engine belted to a generator. The ringing and other auxiliary machines, if any, are in duplicate, one set being operated from the power mains and the other set from the storage battery.

Having the two charging outfits, the question arises as to which should be operated regularly, the other being held for reserve. Among the many considerations to be weighed, that of cost is usually the most important. Knowing approximately by test or from information received from the manufacturers the efficiency of the motor and the consumption of the gas engine at the loads on which they operate, it is a simple matter to compare the cost of the two powers. For example, with gas at one dollar per one thousand cubic feet and the consumption of the engine being thirty-five cubic feet per kilowatt-hour delivered to the generator shaft, the cost of the power at this point would be 3.5 cents per kilowatt-hour. Assuming a motor efficiency of eighty per cent, it will be seen that the electric power would be more expensive if the cost per kilowatt-hour at the motor terminals were above 2.8 cents. By estimating the daily generator input an approximate saving per year can be figured.

To offset the saving which can usually be shown in favor of the gas engine power, there is sometimes an increased cost of attendance incident to the operation of the engine. This is more apt to be the case in a small exchange, where the size of the maintenance force may make it desirable at times to leave the charging machine running for a considerable period without any one being in the building to give it attention. It would be permissible to do this with a direct connected motor generator set, while it would hardly be so with a gas engine. In an office large enough, however, to require the presence at the exchange of some one competent to handle a gas engine during the entire period when the batteries are being charged, the difference in the cost of attendance can be disregarded. If the electric power circuit is in operation at night only, the gas engine has a considerable advantage in that it can be operated during the day time, when the regular maintenance force is at the exchange, night attendance can be omitted, and possibly a considerable saving effected in this way.

The cost of maintenance and repairs would be somewhat greater with the gas engine run as the regular charging outfit than with the motor. Probably a figure of from $30 to $40 per year would fairly represent this difference in a medium sized plant, and would include such items as renewal of spark plugs, increased lubrication and increased special repairs. The depreciation charge will be practically the same with either set held as the reserve.

The location of the gas engine and the question of noise are matters that must necessarily be considered in relation to its use as a regular or reserve power. The most convenient location from the standpoint of attendance is, of course, with the remainder of the power apparatus, which is usually placed in the terminal room, with the distributing frames, test desk, etc. If run regularly in this location, the noise of the engine might interfere seriously with the work of testing; whereas, if used as a reserve this objection would be present only in case of an emergency, or during the short periodic runs which are necessary to keep the parts in good working order. If the engine is to be run daily, therefore, it is well to place it in the basement or in a room on the first floor, other than the terminal room, and to have the exhaust well muffled. The character of the neighborhood may also have a bearing on the advisability of running a gas engine regularly, as for instance in a high-class residence locality objection might be made to the noise of the exhaust even though muffled as far as possible.

If the decision is reached to operate the gas engine regularly for charging, it may be possible to effect a still further economy by running the ringing machine from the battery at all times. It is customary to us the battery driven set at night in any case to insure a continuous supply of ringing current, if the exchange is left without any one in the terminal room who can take the necessary action if the electric power circuit is disabled. Assuming the cost of gas engine power delivered to the generator shaft to be 3.5 cents per kilowatt-hour (which is the figure used above), the efficiency of the charging generator to be seventy-five per cent, and the watt-hour efficiency of the battery to be eighty-five per cent, the cost of battery power will be approximately 5.5 cents per kilowatt-hour. If the efficiencies of the battery driven and power ringing machines are the same, any cost of the electric power above this figure will result in an economy in favor of the battery driven ringer. The practice of running the ringing machine continuously from the battery, however, requires an increase in the size of the battery to retain the necessary reserve capacity, and the annual charge on this increase in the battery plant should be placed against the plan of operating the battery driven set.

There is one consideration outside the engineering features of the problem, which may be of considerable importance in a study of this kind; the business relations of the telephone company with the company supplying the electric power. These relations are usually close and may embrace agreements covering joint occupation of pole lines, etc. Moreover, the telephone company being a large user of power during the day time can expect under these conditions to obtain good rates. If the gas engine power is used, it is natural to expect that the co-operation between the two companies will not be so cordial, and the telephone company will be called upon to pay for leads to its reserve machines and other privileges which would otherwise be given freely.

MODERN TOLL SWITCHBOARD EQUIPMENT

The Continuation of a Series of Articles Dealing with this Important Subject

By J. E. Hilbish, J. B. Thiess and G. A. Joy

[Article 9. The preceding article appeared in the May TELEPHONY.]

IN the preceding article we showed that by the method known as simplexing, it was possible to transmit a telephone and a telegraph message over one pair of wires simultaneously. This was certainly a step in the right direction, but by the scheme known as compositing, to which we will devote this article, it is possible to send simultaneously one telephone and two telegraph messages on the same pair of wires, ground being used as a return for the telegraph circuit; or one telephone and one telegraph message if but one wire is used, in which case ground is used as a return for both circuits. Thus it is possible, by this latter method to operate the very expensive toll lines at a telegraph efficiency which is fifty per cent higher than that which can be obtained by simplexing; consequently if a telephone company can create a sufficient demand for telegraph service, the exchange manager can by compositing his toll lines greatly enhance the earnings of the invested capital. This is true because of the fact that from fifty to seventy-five of the total cost of the telephone system is in the poles, cables, conduits and wire, and therefore any additional expenditure on the switchboard apparatus which will increase the earning power of the wire plant is a very profitable investment.

In the simplex circuit both telephone leads are operated in parallel for the telegraph or morse wire, while in a composite system each conductor constitutes a separate morse wire. Consequently, with the composite system the interfering of the telegraph with the telephone message must be guarded against; and there is the additional complication that the telegraphic message on one wire might interfere with that on the other, which effect is commonly known among telegraph operators as "cross writing." There are naturally several practical methods by which a line may be composited. The following is the method used with great success by the American Bell Telephone Company. In Figure 31 is shown an ordinary grounded telephone circuit composited for telegraphic work. Before going into a detailed description of the operation of this circuit we will devote a few lines to the description and functions of some of the apparatus.

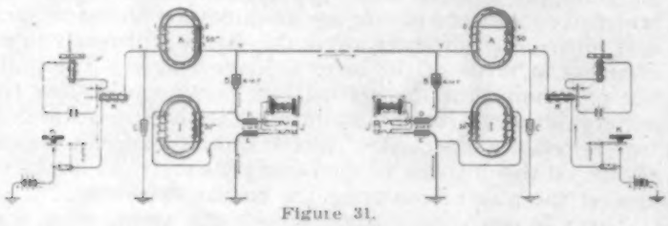


Figure 31.

To begin with, the retardation coils A and A each consist of two windings whose combined resistance is fifty ohms on a very heavy soft iron core of the closed magnetic type. Those windings are connected differentially as shown in the circuit and the action of the coils is as follows: To direct or pulsating current of a low frequency such as is produced by the manual operation of the telegraph key, this coil acts as a non-inductive path since the inductance set up in one-half of the coil is counteracted by that of the other. However, with the high frequency voice currents of small strength the action of the coil is entirely different, in fact the effect of its massive core might be termed sluggish, since the alterations of the voice currents seem to be too rapid to give the magnetism in the entire core a chance to change for each reversal of the current. Consequently each winding of the coil acts as a separate and distinct impedance to the voice currents and it is practically impossible to force them through the coil. The reason for using a coil of this type in place of an ordinary impedance coil is that the introduction of the latter in a telegraph circuit makes the operation of the telegraphic apparatus sluggish, which action is very detrimental to the work of the telegraph operator. Coils I and I' are also composed of two windings, and their combined resistance is thirty ohms. These windings are also placed on a massive soft iron closed magnetic core, but are connected in series so that the windings both magnetize the core in a like direction; hence this coil offers a considerable impedance to any alternating or pulsating current.

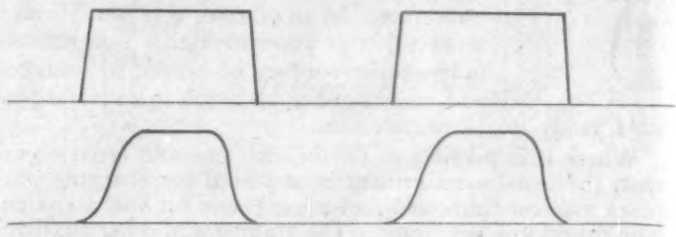


Figure 32.

Since the remainder of the apparatus in the circuit is not of special design we are now ready to look at its operation, and in order that this description may be as simple as possible, we will first trace the telegraph and then the telephone circuits.

When the telegraph operator at key K is sending, he will throw a pulsating current out on the line by way of relay R to point X. At this junction the current has the option of two paths, one by way of condenser C to ground and the other by way of coil A to point Y. Now since coil A offers a practically non-inductive path to a pulsating current of low frequency, as has been previously explained, the telegraph current will choose this path. However, the joint action of condenser C and coil A on the telegraph current brings about very beneficial results. The current as chopped off by the telegraph key is sharp cornered and results in practically a rectangular wave, since it rises to its maximum and falls to its zero value almost instantly upon the make and break of the key. Due to the action of the above mentioned apparatus the current appears at point Y with the corners well rounded off, consequently appearing more like a smooth curve approximating a sine wave. In Figure 32 is shown the transformation that the rectangular wave experiences when acted upon by capacity and inductance as explained. This joint action is brought about in the following manner: The telegraph operator upon depressing his key causes a heavy flow of current to point X where coil A will act as a barrier to the inrushing current and condenser C will be fully charged before the current in the line can reach a maximum value, and upon the opening of key

the condenser C tends to discharge in the direction of the original current and to oppose the discharge from the line, thereby tending to maintain the flow of current in the line and thus causing a more gradual decrease. Thus the combined action of this coil and condenser prevent any very marked and abrupt fluctuation of current in the line. The telegraph current having been traced to the point Y is now out on the telegraph line and will for the reasons cited above choose a like path at the other end of the line and will consequently operate relay R'. Should any of the telegraph current leak through condenser B, it will not disturb the telephone circuit since it will be shunted around the latter by

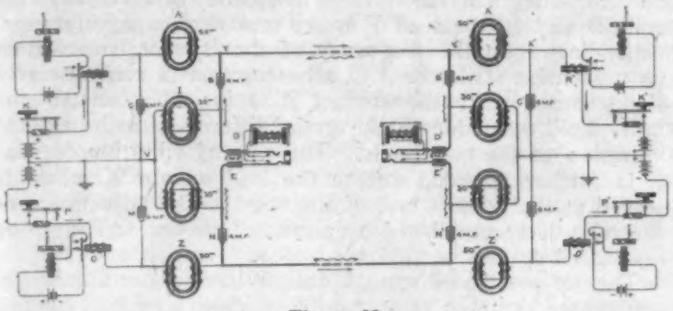


Figure 33.

way of coil I to ground, this path offering considerably less impedance to low frequency current than the path through condensers D and E. Due to the large amount of reactance in the line, there is an inductive line kick every time the circuit is made or broken at the telegraph key. The inductive kick due to relay R and winding 1 of coil A is absorbed by condenser C and hence passed to ground, while the kick due to winding 2 of coil A is absorbed by condenser B and passed by means of coil I to ground. This action of coil I has given it the name of "frequency sieve," as it absorbs the comparatively low frequency inductive kicks of the line and passes them to ground, at the same time acting as an absolute barrier to the high frequency voice currents, which it forces through condenser E and the telephone instrument.

Turning now to the telephone circuit we see that the high frequency voice currents will readily pass through the condenser E, D and B, and will be choked out of the telegraph circuit by means of the impedance coil A. The current will consequently flow over the line to y' where it is again choked out of the telegraph circuit by coil A' and will find a ready path to ground through condensers B' and D' the telephone instrument, and condenser E'. Thus the telephone current is kept out of the morse leg and telegraph current cannot interfere with the telephone circuit. The paths of the telephone and telegraph current can be readily traced by means of the arrow notation.

The principles adopted in the compositing of a ground line, explained above, are all applicable to the compositing of a metallic line, but in this latter operation the additional difficulty of cross writing must be guarded against. The circuit of a metallic line composited is shown in Figure 33, and it will be noted that the arrangement of apparatus is very similar to that shown in Figure 31, and since the apparatus, such as the retardation coils A and I, is identical with that previously described, we can start immediately with a narrative of the operation of the circuit. When the operator at key K is sending, the pulsating current will flow as previously described, through relay R and coil A out on the telegraph line and hence by way of coil A' and relay R' to battery. The action of condensers C, B, D and E and coils A and I, is identical with that described for the grounded circuit. However, in this case we have two morse wires and it will be observed that these wires are interconnected at four points by means of more or less capacity and inductance; this condition being necessary to obviate the interfering of the telegraph with the telephone circuit. It will further be noticed that all these interconnection circuits are grounded at their middle point, which condition is necessary to prevent cross writing. To demonstrate, when the telegraph operator at key K is sending, a pulsating current will flow to point X at which point some of it is liable to leak through condenser C, and in case V were not grounded find a path through condenser M and thus out on the other morse leg. In a similar manner when the operator at key P is sending, the current would in a like manner get out onto both morse wires. This condition would result in a great confusion of signals and make telegraphing practically impossible.

With point V grounded these stray currents will naturally pass directly to ground at said point and will therefore not flow from one morse wire to the other. The operation of the telephone circuit is the same as described for the grounded system, the ground return being replaced by the second morse wire. In passing, it might be well to state that for the most satisfactory operation of the telephone circuit condensers D, D', E and E' must be limited in their capacity, a capacity of two microfarads as we indicated in the circuit depicted in Figures 31 and 33, giving very satisfactory results. Although it is a well established fact that as the capacity of a condenser is increased the efficiency with which it will transmit voice current is likewise enhanced, the limit to which the capacity of the above mentioned condensers may be raised is soon reached. This is due to the fact that as the potential of the telegraph line rises and falls with the make and break of the telegraph key, a very noticeable disturbance will be created in the telephone circuit on account of the larger charge and discharge currents in these condensers. In fact there is a circuit in use giving very satisfactory results in which these condensers have been omitted entirely. In case this is done, however, a redistribution of the rest of the capacity in the circuit is desirable, and usually we find that condenser C is raised to twelve microfarads and B is reduced to two.

The most serious objection to the composite circuit arises from the fact that it contains so much capacity to ground, for when the telegraph circuit is closed these condensers must be fully charged before the telegraph current on the

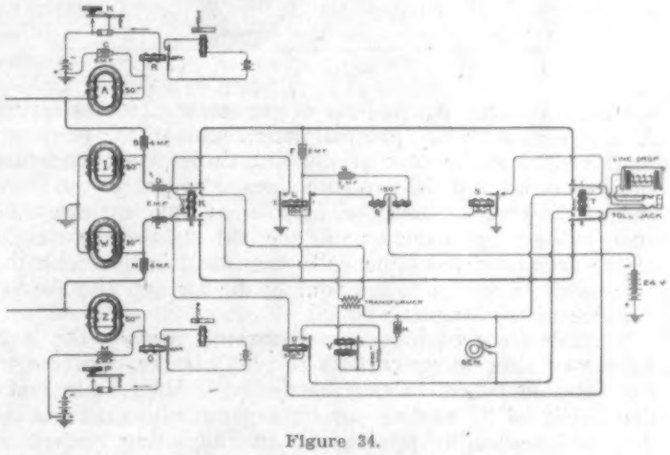


Figure 34.

line will attain its maximum value and hence the telegraph relay will not respond instantaneously to the touch of the key. This condition is rather detrimental when fast sending is being done but for ordinary work the operation of the circuit is very satisfactory.

Another so called objection to this system is that the ordinary telephone generator can not be used for signaling the telephone exchange, as the frequency of this ringing current is low enough to find a path through the coils A, A', Z and Z', causing the telegraph relay to chatter. This difficulty is avoided by a special composite ringing device and circuit shown in Figure 34. In this circuit are shown

the telegraph apparatus for each morse wire and all the necessary telephone equipment, but since the flow of the voice and telegraph currents have been described we will confine our attention to the scheme utilized in obtaining non-interfering ringing current. Here we find several pieces of apparatus of special design which merit a description before we discuss the operation of the circuit. In the first place relay L is so designed that it will be actuated by an alternating current of low frequency such as is generated by the ordinary exchange ringing dynamotor. The construction of this relay is depicted in Figure 35 and we refer the reader to this sketch in following the ensuing description. The sketch shows a top and side view of the relay. It will be noted that the armature of this relay is very massive and heavy and consequently its inertia is sufficient to hold it in place when once attracted even though the magnetizing current is alternating in character and passes through a zero value once during every cycle. It will further be observed that the contact springs are long and flexible, so that even did the armature have a tendency to vibrate slightly, the springs will follow it and prevent the opening of the circuit. The break contact is held in place by the weight of the armature, a rubber bottom on the latter normally resting upon the upper spring of this pair of contacts; while the make contact is actuated when the armature is drawn up, due to

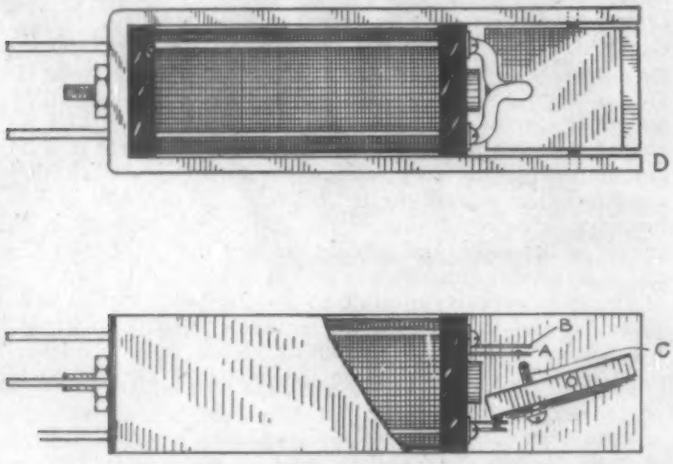


Figure 35.

the fact that the insulated tip of set screw C forces spring A in contact with B. The magnetic circuit of the relay can be traced from the core of the coil, through the armature and hence through the two iron sides D and E, to the front end of the core. Therefore, as soon as sufficient magnetic energy is set up in the core of the coil to raise the weight of the armature, the same will place itself in line with the core so as to reduce to a minimum the air gap and the reluctance of the magnetic circuit.

Another piece of ingenious apparatus, namely, the high frequency alternating current relay Q is the converse of that just described, in that its design is such as to make the inertia of its moving parts comparatively small so that they will be readily affected by an alternating current of high frequency. This relay is shown in Figure 36, and it will be noted that its design is a radical departure from that ordinarily followed, and that the principle upon which it operates is that utilized in an ordinary polarized bell. This is accomplished by the permanent magnet A, which energizes cross piece D, thereby producing a pole of opposite polarity to that of A in the core of coils B and B′, by means of the path furnished by supports G and G′. At the other end of magnet A we find that the reed F is magnetized, due to the path furnished by support H, hence at the coil end of this reed polarity the same as that of A will be established. Thus the cores of the coils have an opposite polarity to that found on the reed, and as they are of approximately equal strength, the pull on the reed is equal, and it is therefore balanced and remains quiet. However, since the coils B and B′ are wound in opposite directions an alternating current traversing them will, for one half of the wave, tend to strengthen the magnetism of one core and weaken that of the other, while for the other half of the wave a reverse action will take place, causing an unbalancing of forces and thereby actuating the reed. This reed F is a stiff steel spring whose natural period of vibration is relatively high. Directly above this reed is another light non-magnetic reed C which makes contact with reed F at point E. The operation of the relay may now be explained as follows: When an alternating current of high frequency is traversing the coils B and B′ the reed F is set into very rapid vibration, depending upon the frequency of the current, and will in its movement strike reed C, whose action is comparatively slow, consequently the contact Z is for all practical purposes held open due to the great difference in the rate of vibration of the two reeds. The rate of vibration of reed C is further retarded due to the lead weight X which is placed at the contact end of this reed. The adjustment of the relay is accomplished by means of set screw E and the associated spring.

The apparatus of special design having been duly described we are now in a position to show how it is used in the ringing circuit and to give a detailed description of its operation. In dealing with this circuit we will first show

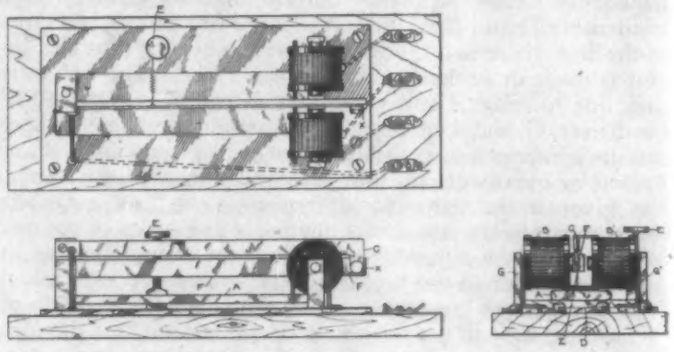


Figure 36.

how the high frequency ringing current is generated and placed out on the line, and then the manner in which the ringing current from another exchange is received and dealt with so as to give an effective signal to the operator without interfering in any way with either of the telegraph circuits.

When the operator desires to place ringing current out on the line, her work in this case will be identical with that required for ringing a party on a standard line circuit, which consists in plugging into the desired jack with calling plug of one of her regular cord circuits and then actuating the ringing key. This operation will cause the low frequency ringing current to flow out over the tip of the jack to the armature of relay T and hence by means of the break contact 1 to the tip of the line, condenser F, the coil of relay L and the sleeve of the line to break contact 2 of relay T and its armature, to the sleeve of the jack. This current will not flow through the shunt path offered by condenser G and the high frequency relay Q, since this condenser has a capacity of only one-half microfarad and therefore offers a considerable impedance to a current of this frequency. Due to the completion of the circuit just outlined the slow acting alternating current relay L will be operated and will attract its armatures. The attraction of armature 1 will open the shunt path around relay L by way of the high frequency relay, and consequently upon the continued application of the ringing current the small percentage which might have a tendency to leak through condenser G will be confronted by an open circuit. At the same time the attraction of armature 2 of relay L will complete a circuit which

may be traced as follows: From the ground on armature 2 of said relay by way of the make contact to the coil of relay K and hence through the coil of relay U to battery. Thus relays K and U will be energized and attract their armatures. The attraction of the armature of relay U will close the following circuit: From the exchange ringing dynamotor to the armature of said relay and hence by way of the make contact to the make contact and armature of the high frequency vibrator V, through the coils of the same and then by way of the primary of the transformer back to the generator. The completion of this circuit will energize the coils of the high frequency vibrator and thus attract its armature, which action will de-energize the coils of the same and cause its armature to return to its normal position, which in turn will close the circuit again, thereby rapidly vibrating the armature and contact. In fact, it will be noted from the above description that the high frequency vibrator is nothing more or less than a buzzer-like contrivance furnishing a current of too high a frequency and too small an amplitude to affect the telegraph instruments. It will be further observed that the armature and make contact of the vibrator are shunted by a non-inductive resistance of 1,000 ohms, the object of which is to reduce sparking at the contact and its resistance is so high that the current which will pass it will be too small to hold up the armature. This vibrator is so designed as to furnish about twenty interruptions or pulsations for each reversal of the ordinary alternator current, and so produces a current of a frequency twenty times that of the alternator. Thus the frequency of the ringing current lies somewhere between 200 and 300 cycles, which will not affect the telegraph apparatus. The function of the condenser H, which is bridged directly across the alternator circuit, is to absorb the high frequency discharge from the coils of the vibrator and so keep them out of the alternator. It will be obvious that as long as relay U remains operated, the vibrator will generate a high frequency current which traverses the primary winding of the transformer. Consequently, we will find induced in the secondary of this transformer, a current of a like frequency which will find its way out on to the line by means of the following path: From the coil of the transformer to the make contact of armature 1 of relay K, which has been previously operated as stated above, and hence, by way of said armature through condensers D and B to the tip of the line, returning by way of the sleeve of the line, condensers N and E, armature 2, and the make contact of relay K to the coil of the transformer. Since this current is of a high frequency it will not be able to force its way through coils A and Z or I and W, so will not interfere with the telegraph instruments.

Having shown how the circuit depicted in Figures 34 is utilized in sending out a signaling current, we will now describe how a like current coming from another exchange is received so as to be effective in operating the switchboard signal without interfering with the telegraph apparatus: This current coming in over the tip side of the line will, upon passing condensers B and D and armature 1 and the break contact of relay K, flow by way of condensers F and G through the coils of the high frequency relay Q to the break contact of relay L and hence by way of armature 1 of said relay to the sleeve side of the circuit, the break contact of relay K, armature 2, and condensers E and N to the sleeve side of the line. The current will choose the path through the high frequency relay in preference to the shunt circuit offered by relay L, due to the fact that the inductance of this latter relay is great enough so that it will offer considerable impedance to high frequency current, and the amount which might force its way through this relay will not be sufficient to energize it. The energizing of relay Q will open the circuit containing relay S, and the latter relay will be de-energized, causing its armature to fall back, and since relay S is slow acting, any momentary closing of the above circuit due to the swinging contact of the high frequency relay will not re-energize it. The opening of the circuit just outlined will close a circuit which can be traced from the ground on the armature of relay S to the break contact and hence by way of the coil of relay T to battery. Thus relay T will be energized and attract its armatures, completing the following circuit: From the exchange generator to the make contact of armature 1, then to the tip of the jack and its break contact through the coil of the toll drop and hence to the other break contact and the sleeve of the jack to armature 2 and the make contact of relay T back to the exchange generator. Thus the regular ringer current will traverse the coil of the drop, and since the morse apparatus is cut off at the break contacts of relay T, the ringing current from the alternator can not affect it.

THE CANADIAN CONVENTION.

THE Third Annual Convention of the Canadian Independent Telephone Association will take place on Wednesday, September 9, 1908, in the city hall, Toronto. Several prominent men, interested in the Independent Telephone movement, are expectd to be present and will address the meeting, including Hon. Richard Turner, Hon. Jules Allard, Hon. Adele Turgeon, and Sir. E. B. Garneau, of Quebec; Rodolphe Forget, M. P., Montreal; J. H. Shoemaker, president of the Iowa Independent Telephone Association, and J. B. Ware, secretary of the International Independent Telephone Association. Arrangements have been made for low fares on all railways to Toronto during the exhibition.

The proceedings will begin at 10 a. m. sharp. A meeting of the executive committee will take place at 8 p. m. Tuesday, evening, September 8, at the office of the secretary, 405-406 Confederation Life Building, Toronto.

The programme of the convention is arranged as follows: The meeting will be called to order at 10 a. m., September 9. The address of welcome by the Mayor and the chairman of the civic reception committee, and the reply by T. R. Mayberry, M. L. A., will be followed by the president's address, reports of secretary treasurer, and appointment of committees.

Some very important and interesting topics have been suggested for discussion, and each one will be introduced with a short address. All present will take part in the discussion on these, as well as on any other subjects which they may wish to bring up. Speeches will be limited to a maximum of ten minutes in each case. A question box will be provided for the use of members who may wish for information on any point, which will be opened after lunch.

The following papers will be read and discussed: Bell Connections, by Dr. W. Doan; Independent Telephones at Railway Stations, by C. Skinner; Organization of Rural Companies—(a) Mutual vs. Joint Stock Companies, by A. R. Walsh, and (b) Rural Line Equipment and the Best Way to Serve the Farmers, by F. A. Dales; Telephone Rates—(a) Rates to be Charged, and the Best Form of Collecting, by A. Hoover, and (b) To what extent should Free Service be given? by A. D. Bruce; Division of Territory between Telephone Companies, by Levi Moyer; Toll Line Connections: How best Effected, by Alexander Neilson and Henry Sneath; The Western Situation and its Future, by F. Dagger; Our Interests in Towns and Cities, by M. Gee; The Independent Movement in Towns and Rural Communities, by T. R. Mayberry, M. L. A.; Exclusive Franchises and Government Regulation, by Dr. A. Ochs.

The election of officers and adoption of resolutions will close the meeting.

Possibly the queerest use for the telephone has been found by a New York stage manager. The dragon used in Wagner's "Siegfried" has a telephone in his inside, whereby the boys who operate him from that location are instructed how to act.

THE FLORIDA TELEPHONE ASSOCIATION

A Report of the First Regular Meeting of the Telephone Men of Florida

By E. V. Cross

THE Florida State Telephone Association convened at Ocala, Florida, July 23. This was the first regular meeting ever held by the telephone men of Florida. It was attended by managers from all parts of the state and representatives of firms throughout the country, manufacturing telephone supplies and instruments.

The convention was called to order promptly at 9 a. m. by the president, W. G. Brorien, of Tampa. He called on Judge W. S. Bullock to extend an address of welcome, which he did in a happy manner. Dr. P. W. Butler, of Leesburg, responded humorously.

E. E. Voyle, telephone line builder, spoke on "Toll Lines: Their Cost and How to Construct Them." W. U. Lathrop, of Bradentown, also took part in the discussion of toll lines.

W. G. Brorien, President. George R. McKean, Secretary-Treasurer.

Mr. Brorien spoke of the treatment of poles by the application of creosote and other wood preservatives. J. A. Helvin spoke of the different kinds of timber most desirable and durable for poles.

W. U. Lathrop gave an interesting talk on "Directories, How Often They Should Be Issued and How to Make Them a Source of Revenue." Mr. Lathrop believes in first class work and thoroughness with the smallest detail as to the location of country customers, so that a stranger taking the description could find the patron in the country.

Edward Scott, of Arcadia, spoke on "Subscribers and Collections." President Brorien then spoke on rates and how to raise them, and advised making confidants of the public. He then introduced the representatives of the different electrical companies who had displays of their goods, and the association adjourned to inspect them. The meeting and the discussion of the papers and addresses proved very interesting and instructive.

At 9 p. m. the delegates, representatives of supply houses, and a few invited guests met at the Ocala House where a banquet was served. George R. McKean, who was the moving spirit in the gathering of the telephone men of the state and to whose admirable work the success of the meeting was largely responsible, was toastmaster. His remarks were very appropriate and pleasing as he presented the speakers to the audience.

The editor of the Ocala *Star* was the first speaker and responded to the toast, "The Telephone an Evidence of a Town's Prosperity and Progress," with an interesting talk.

Dr. P. W. Butler, of Leesburg, spoke to the toast "The Telephone Business as a Tonic and Rejuvenator."

H. A. Grant, of the Florida Electrical Co., was introduced as the gentleman from the metropolis of the state who was responsible for this gathering. He is a thorough electrician and believes in co-operation and the association as a factor in indicating the benefits of the system to the people of the state.

E. E. Voyle, the Gainesville telephone promoter, was complimented by the toastmaster as the vice president of the association and one whom they would be pleased to hear from, but he modestly declined as he was too busy with thoughts of telephonic improvement to declaim.

W. H. Atkins, of Atlanta, who is as intimately associated with the telephone system of the south as any man and who has been in the business since it first claimed public attention, was called on and responded with a number of amusing anecdotes.

J. A. Helvin, of the Stromberg-Carlson Telephone Company, of Rochester, N. Y., spoke to the sentiment, "The Telephone: Yesterday, Today and Tomorrow," and made a splendid talk on the progress of the telephone in its history of thirty years and the wonders it has brought. He touched on the resources of the south, its inexhaustible amount of coal, iron and cotton and its bright future. He said that he had visited twenty-eight states in the interest of his business and in none did he see a more hopeful condition for the growth and development of its service, stating that the business condition of the telephone interests in the state was such today that by judicious management all connected with it would soon be prosperous.

This ended the flow of eloquence and at 12:40 a. m. the toastmaster turned the meeting over to President W. G. Brorien, of Tampa, and moved the association adjourn until nine o'clock the following morning.

The second session of the convention was devoted entirely to business matters of interest to the association. At this meeting a constitution and name were adopted as follows:

CONSTITUTION.

ARTICLE 1. NAME.—The name of this organization shall be the Florida State Telephone Association.

ARTICLE 2. OBJECT.—The object of this association shall be the protection of all telephone interests of common concern to the members of this association, to encourage the building of telephone exchanges throughout the state, the bringing about of a complete system of inter-municipal communication in this state at a reasonable charge for rentals and tolls, so that the telephone may be within the reach of the masses of the people.

ARTICLE 3. MEMBERSHIP.—Any individual, partnership, or corporation, organized under the laws of the state of Florida, engaged in the operation of a telephone exchange or toll line operating in the state of Florida, may become a member of this association upon a majority vote of those present at a regular session, by complying with the following conditions: The payment of a regular membership fee of $3 annually, and such assessments as the association from time to time may levy, not to exceed $5 per annum, including

the membership fee. Manufacturers, or dealers in supplies or their agents may become honorary members of this association by paying the same dues as regular members, but shall not have the right to vote at its meetings, hold any office, or attend executive sessions.

ARTICLE 4. OFFICERS.—The officers of this association shall consist of a president, vice-president, a secretary and a treasurer, which latter two offices may be filled by one and the same person.

ARTICLE 5. EXECUTIVE COMMITTEE.—The president shall within sixty days after the annual meeting, appoint three members who, with himself and the secretary, shall constitute an executive committee of five. The president shall also fill all vacancies in said committee within thirty days after they occur.

ARTICLE 6. ELECTIONS.—The officers herein provided for, shall be elected by ballot upon the adoption of this constitution and thereafter annually, and shall serve until their successors are elected and qualified.

ARTICLE 7. MEETINGS.—There shall be a regular annual meeting at such place, and on such date as the executive committee may designate, unless provided for by the convention at its last regular meeting. Special meetings may be held at the call of the executive committee. The call shall state specifically the purpose of such meeting and no other business shall be transacted.

ARTICLE 8. QUORUM.—At all regular meetings, any number present shall constitute a quorum. At special or called meetings, ten shall constitute a quorum.

ARTICLE 9. AMENDMENTS.—This constitution may be amended at any regular annual meeting or any special meeting called for that purpose, for which due notice of the proposed amendment has been given by mail to each of the members at least ten days before said meeting, upon the affirmative vote of a majority of all representatives present at such meeting, provided not less than fifteen voting members are present.

The following officers were re-elected for the ensuing year: President, W. G. Brorien, of the Peninsular Telephone Company, of Tampa; vice-president, E. E. Voyle, of the East Florida Telephone Company of Gainesville; secretary-treasurer, George R. McKean of the Ocala Telephone Company, Ocala.

At the close of the convention the following resolutions were presented and passed unanimously:

RESOLVED, That the thanks of the Florida State Telephone Association be extended to the Benevolent and Protective Order of Elks for the use of its club rooms for the holding of the sessions of this association in annual convention, and to the citizens of Ocala generally for the generous welcome given and the courteous treatment shown the members collectively and individually.

RESOLVED, That the thanks of the Florida State Telephone Convention be given to the Ocala Telephone Company for courtesies shown by permitting the use of its lines and exchange in demonstrating the practical working of instruments, appliances, etc., on exhibition and in the carrying on of long distance talks with Gainesville, Tampa, and Jacksonville, thereby promoting interest in this all important phase of the telephone business.

RESOLVED, That the sincere thanks of the Florida State Telephone Association be extended to Mr. C. I. Bittinger, editor of the Ocala *Evening Star* for his most excellent report of the proceedings of the convention and for the inspiring response made at the banquet to the toast, "The Telephone as an Evidence of a Town's Prosperity and Progress."

EXPERIMENTS WITH A TELEPHONE GENERATOR

The Commercial Applications of Alternating Current Illustrated with Simple Apparatus

By Paul H. Woodruff

THE common telephone hand generator of the bridging type is a true alternating current dynamo with two-pole permanent field and two-pole armature. Driven at the usual speed of about twelve hundred revolutions a minute, which may be attained by means of the five-to-one gear provided with the machine, it generates current at twenty cycles, or twenty-four hundred alternations.

Various factors contribute to loss and inefficiency in a machine of this type; so while the voltage may be between sixty and ninety, the current is very small—possibly one-fourth ampere on short circuit. As a rule the wave form does not approach a true sine curve, although it varies largely with different machines.

Notwithstanding these deficiencies, there is scarcely an application of the single-phase alternating current that may not be experimentally reproduced with the aid of the hand generator.

Miniature incandescent lamps are obtainable for such a variety of voltage, current, and even efficiency requirements that it is an easy matter to arrange them in series and multiple to an aggregate candlepower of eight or more without exceeding the capacity of our machine. There is not, however, enough current to maintain an arc, though the potential is sufficient. The arc principle may be illustrated by touching the terminal wires to a little pile of carbon dust, which produces brilliant sparks and flashes between the particles.

The advantage of alternating current for lighting lies in the use of transformers. The construction of a miniature transformer suitable for the current of the hand generator is a simple matter.

Dismantle an ordinary eighty-ohm telephone ringer, discarding everything but the coils with their cores and yoke—that is, the electro-magnet part of the ringer. This may be mounted upright upon a suitable base, and the windings

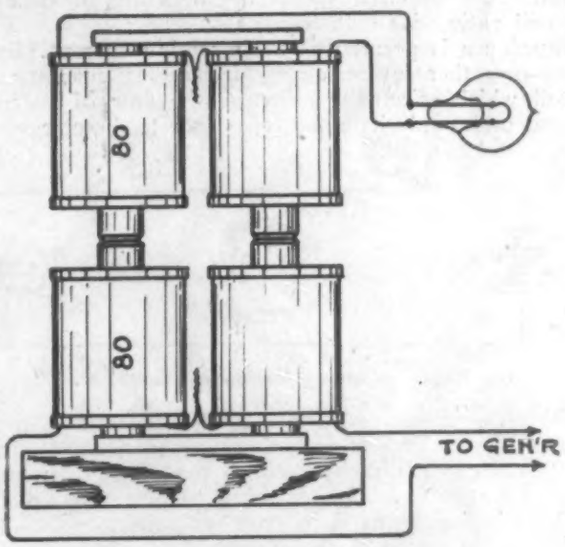


Figure 1. Experimental transformer.

connected to terminals. This constitutes the primary of our transformer.

For the secondary an exactly similar electromagnet taken from another eighty-ohm ringer serves admirably. Inverted and placed squarely upon the poles of the primary, it completes the magnetic circuit. Be careful to see that the ends

of both cores are square and clean, and free from the brass caps or pegs which some manufacturers place upon their ringer cores.

The number of turns of wire in primary and secondary being the same, theoretically we should get the same voltage at the secondary terminals; but losses are so great as to render the actual output problematical. However, we shall have no trouble in lighting a small lamp placed in the secondary circuit, as shown in Figure 1, which is sufficient for purposes of demonstration. With a good generator the lamp may be lighted even with a sheet of paper between the primary and secondary, which adds to the interest of the experiment.

It is obvious that the secondary may be varied by the

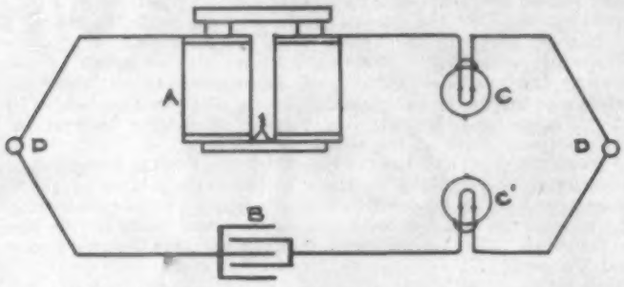


Figure 2. Experiment showing properties of capacity and impedance.

use of ringer-coils of different resistances, and by connecting them in series or in multiple; but beyond the experimental interest there is little advantage in making such changes, because the output in any case is very small.

An interesting experiment may be performed with this apparatus showing the action of impedance. Remove the transformer secondary, and into the primary circuit insert a lamp of low voltage and current requirement. Enough current will pass through the coils to light the lamp. Place the secondary upon the primary, and the lamp will become dark, because the closed magnetic circuit concentrates the lines of force and offers greater impedance. Now close the secondary circuit, and the lamp lights up again; the lines of force are used in generating secondary current, and the primary impedance is reduced. Thus we may have a lamp burning in both circuits, but the breaking of either circuit will extinguish both lamps.

Impedance is peculiarly an alternating current phenomenon—or rather say an effect of changing current values. A coil which effectually obstructs the flow of alternating current offers only its ohmic resistance to direct current.

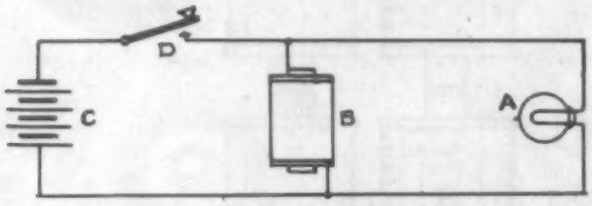
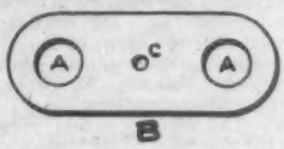


Figure 3. Simple impedance experiment.

Capacity, represented by the condenser, is complimentary to impedance. Presenting an absolute barrier amounting to an open circuit to direct current, it appears to offer little resistance to the flow of alternating current; the condensed surfaces being alternately charged and discharged with the reciprocating action of the current.

A circuit illustration of this principle is shown in Figure 2, in which *A* is a pair of eighty-ohm ringer coils, with a bar of iron across the poles; *B* is a one-half microfarad condenser, such as is used in telephones; *C* and *C'* are twelve-volt, two-tenths ampere lamps; and *D'*, *D'* are terminals. An alternating current sent through this circuit lights only lamp *C*; while to a direct current, lamp *C'* alone responds. This principle has been used in selective signaling on telephone party lines.

In this connection it may not be amiss to mention an interesting impedance experiment which, while performed with direct current, illustrates the impedance principle very clearly. In Figure 3, *A* is a six-volt lamp; *B* is a simple



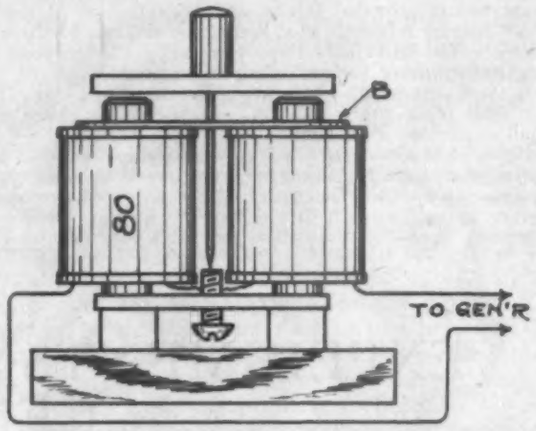


Figure 4. A model alternating current motor.

coil of a half pound of number sixteen magnet wire on a half-inch iron core; *C* is a six-volt battery, and *D* is a switch or contact. Upon closing this circuit suddenly, the lamp flashes up momentarily, and goes out again. The sudden flow of current acts precisely like an alternating current; the coil objects to quick changes, and while its molecules are moving to accommodate the lines of force, the

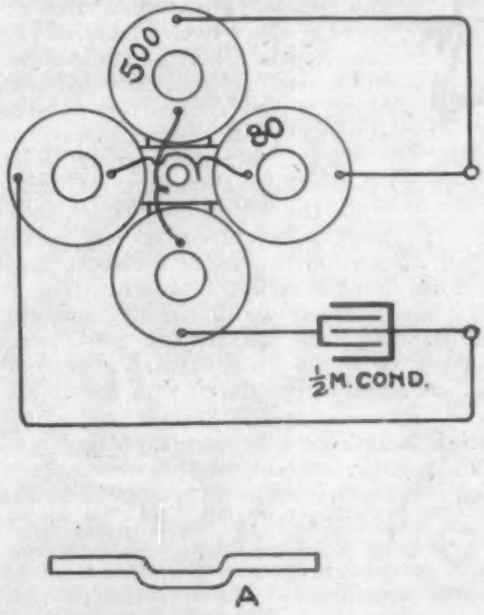


Figure 5. The rotating field.

lamp momentarily offers the better path. Then the coil adjusts itself and the current deserts the lamp for the low resistance of the heavy wire.

When the circuit is broken, the lamp again flashes. The coil has again refused to change quickly; and as the mag-

netic lines of force ebb in its core, they generate current in its wire, which finds its only path through the lamp.

In the application of alternating currents to power work, there are two great classes of motor used. The synchronous motor is the oldest and simplest, its speed depending, as the name indicates, on the period or frequency of the exciting current.

The primary portion of the transformer we used in our lighting experiments will form the stationary armature of our motor, which is to be of the revolving field type. In the center of the yoke, between the coils, drill and tap a hole for an eight-thirty-two screw. Very likely there is such a hole already there. Drill a small hole a sixteenth inch deep in the end of a half-inch eight-thirty-two brass machine screw, and insert it into the hole in the yoke from the under side.

In a piece of sheet brass of the shape indicated by *B*, Figure 4, drill holes *A* and *A'* of a size and location to fit tightly over the ends of the cores at the top of the electro-magnet. The third hole, *C*, in the center, is about one thirty-second inch in diameter.

For the revolving field, cut a piece of tool steel one and three-fourths inches long, a half inch wide and about an eighth thick. Through the center of this drill a hole a little less than a thirty-second inch. Then harden and magnetize. A straight bit of steel wire or a needle, of a size to fit tightly in the hole, forms the shaft. It should be of such a length that when the sharpened end rests in the hole in the brass screw at the bottom of the electro-magnet, the steel permanent magnet swings just clear of the ends of the cross. This clearance may be regulated by turning the screw, and should be as small as possible. A bit of the shaft extends above the steel magnet, and is provided with a knob whereby to spin it in starting. Figure 4 is the completed motor.

Synchronous motors are not self-starting. With the stationary armature coils receiving current from the telephone generator, spin the field magnet rapidly on its shaft. Since it has the same number of poles as the generator, it must be run up to the same speed by hand before it will "fall into step." Running the generator slowly will of course make it easier to start the motor. It will run in either direction, as it is started. So long as it is not interfered with it will continue to run at the speed of the generator; but if thrown out of step it will stop and must be started manually again.

The induction motor is considerably more interesting in theory than the synchronous. Though not self-starting on single-phase currents, it needs but a little assistance, and its speed is independent of the frequency within certain limits.

The construction of our model is in all ways similar to the synchronous motor, except that for the steel permanent magnet, we substitute a copper or brass disc, one and three-fourths inches in diameter and one thirty-second or less thick. But with the construction the resemblance ends. The revolving copper disc is the armature; the ringer coils and cores are the field, whose poles attract the currents generated in the disc by induction from themselves. Just a slight twirl in either direction will set the motor spinning at a good rate of speed. The action of the model is rather delicate, however, since there is no iron in the armature; and to insure success we must be very careful with the pivots of the shaft, so that it revolves practically without friction.

For the experiment of the rotating field a two-phase current is necessary—which is really two alternating currents with their phases at right-angles to each other. This we cannot obtain from one hand generator; but with the aid of a condenser we may imitate the effects to some extent.

We shall need both eighty ohm and five hundred ohm ringer coils. They must be mounted at right angles, as shown in Figure 5, which will probably necessitate making a special yoke for one of them of the shape indicated by *A*; for all four core ends must be in the same plane.

Figure 5 shows the circuit for this arrangement. The eighty-ohm coils are connected directly to the generator; the five-hundred-ohm coils have a one-half microfarad condenser in their circuit. This, together with the numerous turns of wire in the high resistance coils, serve to retard the alternating current waves until the phase no longer corresponds with that through the low resistance coil. The result is that the magnetic poles at the ends of the coils succeed each other around the group in a circular effect.

To make this action visible, we need only place a shallow paper box on the poles. A little metal ball will move about this box in a very lively manner. Metal objects suspended just over the poles will also show the rotary motion.

But the practical use of the rotary field is shown when we rebuild our induction motor by adding the revolving copper disc or armature to this four-pole field. We now have a perfect self-starting induction motor.

It is only fair to the experimenter to state that these two-phase effects, as obtained with the condenser, are somewhat difficult of adjustment and not always satisfactory. With a little ingenuity two hand generators may be mounted side by side upon one base, with their gear wheels intermeshed so they will revolve together. If the two armatures are arranged at right angles the result is a true two-phase generator. Two eighty-ohm ringer electro-magnets mounted at right angles and each connected separately to its own generator will furnish a rotating field of some little power, which may be used in the construction of a model two-phase, self-starting induction motor.

To return to the model transformer; if extreme simplicity is desired, the electro-magnet from a single ringer will illustrate the principle nicely. Simply connect one coil to the generator, the other to a low candle-power lamp. A bar of soft iron across the poles completes the machine.

The commercial applications of the alternating current are shown quite satisfactorily by the foregoing simple experiments. A host of further operations within the scope of the little hand generator will suggest themselves to the experimenter who is sufficiently interested to have performed these—and perhaps, after all, the effects one discovers for himself are the most interesting.

COMPETITION IN COUNCIL BLUFFS.

THE actual operation in Council Bluffs, Iowa, of two competing telephone systems, the Bell and the Independent, is declared to have overturned many local theories as to the disasters and inconveniences which, it was predicted, would follow the advent of a second company.

One surprising feature of the present situation, both in Council Bluffs and Omaha, is that the total number of telephone subscribers has so increased that, despite the large number of telephones installed by the Independent companies in both cities, the Bell exchanges have also increased their number of subscribers.

As a general rule the business houses are the only subscribers who carry both telephones, and that the increased expense to them is more than compensated is shown by the declaration of a prominent Council Bluffs merchant while talking with F. J. Day, president of the Council Bluffs Independent Telephone Company.

"I was opposed to giving you a franchise," said the merchant, "and I fought it as hard as I could. Now I have changed my mind. Two telephone companies are a good thing. Formerly I had to send a man out to canvass my customers for their orders. Now that same man can sit at the telephone and reach everybody."

Charles F. Brush, the millionaire electrical inventor, has installed a second private branch telephone exchange in his home for the exclusive use of his servants.

The Inspector and The Troubleman

By A. E. Dobbs

[Fifth installment.]

WILL GOES SURVEYING.

"WILL," said George one morning, "I believe I will give you an opportunity to learn something of practical building. We have a line to build from here to N——, and I believe I will take you and Tom along, leaving Johnson here to do the work of looking after trouble while we survey a toll line which we are going to build to that town to connect with the new long distance line that will pass through there next week. Mr. Risk has already secured rights of way and the necessary permit from the county commissioners, so that all we have to do is to go ahead and stake out the line. We will fill that push cart with stakes we got cut for that purpose down at the planing mill, take along two hand axes, a No. 14 wire measuring line 132 feet long—for that is the distance we set our poles apart, 40 to the mile—and lunches for all of us, for we are not coming back for dinner; and when quitting time comes Mr. Risk will drive out with his wagon and pick us up. You and Tom can take turns at trundling the hand cart."

"What kind of a line are you going to build?" asked Will as they proceeded to their starting point.

"Well, the line will, in the main, be built of twenty-five-foot cedar poles with six-inch tops which must measure not less than eighteen inches in circumference at the top and ten inches diameter at the butt. We also have some chestnut poles, slightly smaller, which is allowable on account of their greater strength. At the present time we will have but one cross arm, but we may, later, have two, one for the toll lines and one for the farm lines we will pick up along the route, for, if I am not mistaken, every farmer will want a telephone as soon as the line is built; and as there is a farmhouse located about every half mile of this route, there will be about sixty or seventy farmers to connect, which will demand about eight circuits, or nearly enough to fill up one cross arm. But we want to string out our two toll lines first and then work up our farm lines, which we can easily do. The toll lines on top will be of No. 10 copper, which will be transposed just as carefully as though we intended to connect with a 1,000 mile line immediately, for, as we will have to do so sooner or later we might as well be prepared for it when it comes. That is the reason we are stringing No. 10 copper instead of No. 9 iron or No. 14 copper. For this same reason we will have to transpose our farm lines as well; for these lines, running alongside of toll lines, will have to be built as metallic circuits."

"Won't the transportation sections on the farm lines have to be shorter than those of the toll lines?" asked Tom.

"Not necessarily," answered George; "but if we find the lines noisy we will cut our sections up into shorter lengths of five poles each instead of ten."

"Well, here is the last pole of our town line, and here is the place we start from. Bring out that measuring line and start from this pole; and remember that I want these measurements to be as accurate as possible. Stretch the line tightly, and if, for any reason, we have to lengthen or shorten a section, such as avoiding a farm gate or the intervention of a cross road, we must shorten or lengthen another section so that our scheme of transportation will not be interfered with. In other words, set your stakes without regard to obstacles, and then if we have to move a pole we will take it out of one or both of the adjoining sections or, if necessary, set an extra pole so that in general all of the rest of the poles will come in proper position. In a farm line it is not important that poles should be evenly spaced, but it is different on toll lines. This road is laid on section lines and in keeping with our agreement we will have to keep as close to the fence as possible so that laying out a straight line will be comparatively easy."

"Are you going to drop from those thirty-five-foot poles down to the twenty-fives?" asked Tom.

"No," replied George. "In any case we should start out with a thirty-foot pole; but as they are selling building lots in this part of town now, we will set our next fifteen poles as thirties, so that we will have room for three or four cross arms if we ever need them. Will, bring me fifteen of those stakes and I will mark them for you. Now you see, each of those stakes is marked 30 and 5, which means thirty-foot poles five feet deep; so that when the teams unload the poles they will know just what to drop. Set the stakes just one foot from the fence so that the diggers will have room to dig all around them, which will line our poles six inches from the fence. Now go ahead, Will, and set the first stake; you can have that honor."

"Those poles back by the exchange are not set according to your plan," said Tom, while Will was going ahead; "I suppose, of course, you will put on two more arms so as to leave the two top arms free for the new lines?"

"Yes," answered George, "those wires will be lowered and some cable hung near the exchange. Our transposition sections we will have to find by actual measurement; but you won't find the poles far out of the way; one of them not more than ten feet, while the other comes just right."

"Stake," cried Will, and the three moved ahead.

A RAILROAD CROSSING.

Three miles from town they came to a railroad track.

"Here," said George, "we must have higher poles. The law requires us to clear the rail by twenty-two feet and also requires double cross arms on each pole next to the track; besides, we have to cross over that telegraph line and give it plenty of room. That telegraph line is on thirty-foot poles set six feet, so that it will take a thirty-five-foot pole to clear it. Now let us see. Our bottom cross arm pin is two feet below the top of the pole, the pole should be set six feet in the ground, the top of the rail is two feet above the level of the ground, while we must allow for a sag of one foot in the wire on a hot day, making a total of eleven feet to be subtracted from the length of the pole; which leaves twenty-four feet as the height of the pole above the rail, which is two feet more than we actually need."

"But will that clear the telegraph line?"

"Certainly! For the telegraph line is on the same level as ours, which takes off two feet that I had to allow for the height of the rail; besides, we cross in the middle of the span where the telegraph wires drop a foot, at the least.

while we have to move our pole out a foot to clear the right of way so that the sag of wires over theirs will not be more than two inches. That takes off two feet more, so that we will clear them by four or five feet easily. Mark those two stakes '35-6.'"

A mile further on they came to a small ravine in which they had to place two poles. George had gone ahead and was waiting for them. "Will," said he, "here is a sketch of this ravine that I have made and I wish you to take it ahead with you as a guide; between poles No. 1 and No. 2 set your stake three inches beyond the end of your line, and do the same for pole No. 3; between No. 3 and No. 4, however, set the stake eight inches beyond your line."

"Why is that?" asked Will.

"To make allowance for the angle caused by one end being higher than the other."

"But the length of wire——"

"Never mind; take this lath with you, fix a piece of white paper to the top of it, and hold it in place until I can sight through. Tom, take these two long laths with you, one of which has paper tied to the top of it, and when Will gets ready come back to stakes two and three and give me the height by sliding the laths upon each other." George had a four-foot lath, over which he sighted toward Will, while Tom, obeying signals from George, adjusted his laths until his marker agreed with the two others, then laid them on the ground, measured the length, and announced twelve feet from No. 3 and eight feet from No. 2.

"Deducting the length of the lath that makes a net of eight feet for No. 3 and four feet for No. 2," said George; "which might mean a twenty-nine and a thirty-three-foot pole except for the fact that pole No. 2 should be set a foot deeper, which makes it a thirty-footer, and as our No. 3 is in rather soft ground that water overflows occasionally it will be set two feet deeper, so it will be thirty-five feet in length, and this will make the top of our line level. If it was not for the fact that we have one or two very crooked chestnuts that we cannot use in town I should not have taken so much trouble with this, as I could have set two thirties in there by cutting off No. 2 to twenty-eight feet and cutting off No. 4 to twenty-three feet which, as there is no road crossing there and never will be, would not have interfered with anybody in any way.

"Oh, Will!" he called out. "Set a stake about ten feet above No. 3 for a slug on the up-stream side. I see by the marks on the banks," he continued to Tom, "that that little two-inch stream sometimes becomes four or five feet deep, and by putting a loose slug guy above it we will hold the pole against washouts in the spring. Of course we do not need to make this guy tight, merely tight enough to keep the pole from pulling out of line when the current washes driftwood against it."

A little farther along they came to a row of trees that extended half a mile and overhung the road. Being a quarter of a mile ahead of the other two, George stopped and looked thoughtfully at the line and then across the road where there were no obstacles in the way.

"Hum!" he mused, taking a paper out of his pocket; "we have the right to trim those trees and thus keep our line straight, but do we want it even at that? As we have to turn north only a quarter of a mile above those trees anyhow, and the opposite side of the road will give us better opportunities for guying, I think we had better cross the road. It would not be so bad if those trees were large and fully grown, for then we could cut a couple of feet off the tops of the poles, trim off some of the lower limbs and not have any more trouble; but these trees are of an age and size that will continue to make us trouble for the next ten years—just about the life of the pole line.

"Swing across to the other side of the road," he told the boys as they came up at that instant. "Survey this line up the other side of the road as far as the next section line where the road turns north and wait for me while I go ahead and see about right of way."

"How about making allowance for the crossing angle?" queried Will.

"Measure one hundred and thirty-two feet."

"But crossing the road will leave us several feet short in our regular distance along the road," persisted Will.

"Well, what of it? We are measuring wire-miles, not surveying land. We set our poles forty to the mile, but they are miles of wire no matter how many curves we may have to follow. I am surprised that you have to be told that. Now as to these corners. I want you to set stakes for a slug twenty-five feet ahead of each pole as well as one at each side. That is the idea which I want you to follow in all work of this kind."

"Why could we not follow that line up until opposite that first tree and put a guy on that?" asked Will.

"Because that tree is young yet. Why, it is not more than eight inches in diameter at the ground, and it will yield to the strain so that the first thing we know it will be leaning out toward the middle of the road. No, indeed! This is a long distance line, and we must take no chances with slack wires, for we cannot afford to have any trouble that can be prevented. Set the head guy about twenty feet ahead of the line, while the side guy, on account of the fence and the cultivation of the land, cannot be set more than five feet from the pole at the most. Make the same layout for the other side and wait for me at the corner above."

George went ahead, secured the necessary permission from the owner of the land, and returned to the corner about the same time that the boys reached it. At the same time, as it was getting late, they espied Mr. Risk and Johnson driving out to pick them up. Mr. Risk had brought Johnson along in order that he might have a chance to look over the line before beginning work. As they passed the trees George could see that they were discussing his change of plans in crossing the road and rightly guessed that there would be an argument on hand.

"Do you consider those trees an insurmountable obstacle?" inquired Mr. Risk as they drove up.

"No, there are no insurmountable obstacles in telephone work, except deep sea cables," answered George; "but it was, in this case, simply a matter of expediency and cost of maintenance."

"You have four guys to hold the poles where you have crossed the road which will cost at least six dollars, and I believe that amount in labor would trim those trees."

"You forget that those trees are close to the fence, so close, in fact, that the wire on the middle pin of the cross arm will rub against the tree while the outside circuit will have to pass to the field side of most of them. Of course you can put on side arms, but you will find that the braces alone for those will cost you more than six dollars, to say nothing of the weakening effect on the line. Besides, we should also have to set an extra pole at this corner to guy to in order to find a place to anchor across the road."

"So far as the extra pole is concerned," replied Mr. Risk, "that will be balanced by the one we will have to set in front of the house back there which we would not have to do if you had stayed on that side of the road. Moreover, this pole at the corner will not be wasted, as I shall probably build a spur line down that south road as soon as those farmers make up their minds that they want our service, as they will within a few weeks."

"Allow me to suggest a compromise," said Johnson. "We all agree that a straight line is a good thing, but we also agree that those trees are very much in our way. Now, could we not move the poles out about four feet from the fence, cut three feet off the tops of them in order to miss the higher branches and trim the trees thoroughly, so as to clear our line? I notice that there is at least five feet be-

tween the fence and the road ditch. Or, if we have to put our poles next to the fence, we can use side arms."

"Give you credit for that idea, Johnson; I did not think of that," said George. "The idea is not a bad one, but what will the county commissioners say to that arrangement? You know we don't want to use side arms if we can help it."

"They want us to keep close to the fence," replied Mr. Risk, "but they do not expect us to do the impossible, and as long as the owner of the land says nothing, they will not; besides, they do not come out in this direction oftener than about once in two years anyhow. By the way," he continued, "did you get right of way for the line across the road?"

"Sure I did, and got his contract for a telephone besides."

"I'd like to know how you did it, for when I was along here he wouldn't even listen to me for either way rights or a telephone."

"So you figured on crossing the road too, did you?"

"Yes, I wanted to be ready for whatever we might happen to determine upon."

"But about this last half mile; shall we cross the road or run it straight?"

"Straight," answered the manager.

"Straight," echoed Johnson.

"Well," laughed George, "as I am outvoted we will set the stakes over again. Boys," he called to Will and Tom, "run your push cart back and pick up the stakes you have set on this side of the road and leave your cart at the farmhouse for the night."

SYSTEMATIC BOOKKEEPING AND COLLECTIONS

A Paper Read at the Missouri Convention and Now Being Sent to Members of the Missouri Association

By A. F. Adams

THE telephone business calls for a more complicated system of bookkeeping than the ordinary commercial business. A good system of bookkeeping for a telephone company should enable the officers of the company to get in summarized form at the end of each month the following data:

Assets and liabilities.
Current assets and current liabilities.
Trial balance sheet.
Gross earnings, less rebates, discounts, mileage, and commissions.
General office expense.
Operating expense.
Maintenance.
Renewal reserves.
Fixed charges.
Surplus.
Construction account.

The construction account should be divided as follows:

Pole Lines.—This account to include cost of poles, cross arms, insulators, guys and anchors, pole irons and sundry pole materials; including also the cost of setting and painting poles, freight, cartage, wages and cost of handling.

Wire and Cables.—This account to include the cost of all line and drop wire, tie wire, house brackets, cable, messenger wire, cable hangers, sleeves, cable terminals and all labor employed, including freight, cartage and all expense up to and including the house brackets, also distributing rings.

Interior Wiring and Equipment.—This account to include the cost of all complete telephone instruments, house cable, interior wire, inside fittings, junction boxes, lightning arresters, and all labor and material employed in installing same.

Subways.—This account to include the cost of manhole frames and covers, eye beams, conduit, cement, paving, laterals, lumber and all freight, cartage, labor and sundry material used in the construction of subways.

Exchange Equipment.—This account to include the cost of new switchboards, switchboard cable, distributing frames, ringing machines, freight, drayage, and the labor used in installing same at the central exchange. This account to be used when plant is extended or improved, and in no case should be confused with repairs to exchange equipment under maintenance.

Booths and Pay Stations.—This account includes the cost of all booths, coin boxes, signs and fixtures installed at central offices and pay stations, freight, drayage and labor employed.

Private Branch Exchanges.—This account to include the cost of private branch exchange switchboards, and cost of installing same complete; and the complete cost of intercommunicating system, including labor and all material used. All interior wiring and telephones installed in connection with private exchange switchboards to be charged as set forth above.

Right-of-Way.—This account to include the cost of all rights and permits, exclusive of franchises, to construct, operate and maintain pole lines or other equipment along or over private property.

Franchises.—This account to include the cost of city or town franchises, granting the right to construct and operate telephone lines and systems and extensions of original property, including expenses incidental thereto.

Construction Salaries.—Charges to this account all salaries applicable to construction work which cannot be distributed according to the foregoing subdivisions.

Ware House Expense.—This account to include the rent of pole yards, ware houses, salary of store keeper, and all expenses incidental thereto.

Construction Expense.—This account to include any items properly chargeable to construction which cannot be charged to any of the other divisions of the construction account.

Other accounts are:

Furniture and Wagons.
Material.
Unexpired Insurance.
Unexpired Directory.

Some companies carry no furniture and fixture account but charge purchases into expense account. This is preferable to carrying them as an asset.

Extreme care should be used in charging any warehouse expense to construction. Regular operating companies should charge all warehouse expenses to maintenance and operation. When a large amount of construction is being done the actual warehouse expense occasioned by construction may be charged to construction.

The gross earnings should be divided into the following classifications, showing the revenue from each division:

Single circuit business telephones.
Single circuit residence telephones.
Party line business telephones.
Party line residence telephones.
Extra name service.
Private branch exchange service.
Toll service.
Messenger fees.
Special service.
Move and installation charges.
Extension telephones.
Extension bells.
Pole and right-of-way rentals.
Rental from office rooms, etc.

General office expenses should be divided into the following classifications:

Salaries and wages.
Soliciting.
Advertising.
Legal expense.
Traveling expense.
Accidents and injuries.
Bond expense.
Miscellaneous office expenses.

Operating expenses should be divided into the following classifications:

Salaries and wages.
Stationery, printing and postage.
Directories.
Light, heat and power.
Taxes.
Insurance.
Poles and right-of-way rentals.
General operating expense.

Maintenance should be divided into the following classifications:

Repairs to pole lines.
Repairs to wires and cables.
Repairs to interior wiring and equipment.
Repairs to subways.
Repairs to exchange equipment.
Repairs to booths and pay stations.
Repairs to private branch exchanges.
Repairs to buildings.
Repairs to tools.
Repairs to horses and wagons.
Miscellaneous maintenance.
Moves.
Take outs.

The above maintenance classifications are defined the same as in the construction divisions.

The take out account should include an arbitrary charge to cover the loss on telephones moved or taken out. Amount of charge to be based on an average of one hundred actual cases.

Great care should be taken to keep from charging items into the construction account which should go to maintenance.

All material when bought should be charged into material account and be credited out to the proper accounts each day it is used.

Whenever any invoice is received and O. K.'d it should be vouchered and passed to the credit of the concern rendering the invoice although payment is not made till a later date. This keeps each month's statement on a comparative basis with previous months.

The earnings, general office expense, operating expense, maintenance, construction, renewal reserve, fixed charges and surplus should be made in the form of a table each month, showing the last month compared with the five previous months.

Many telephone companies think they are making money when they are not, due to not making allowance for depreciation in the shape of a renewal reserve. In this respect a telephone company may be compared to a life insurance company. A reserve must be built up during the first few years when the maintenance is low in order to take care of the heavy maintenance when the plant is old. Start with a new plant built in a standard manner and the amount necessary to spend for maintenance the first years will be much less than the last years. Consequently the plant must earn and set aside a reserve to cover the invisible rot and wear and tear which will suddenly become apparent when the plant gets old, just as the life insurance company must set aside a reserve in the first few years to take care of the heavy death rate later on. The above is a body around which a good bookkeeping system may be built. Various detailed reports, check ledgers, rental ledgers, etc., must be used and can all be worked out to the individual needs.

The collection of accounts is the heart of the telephone as well as any other business, and close attention should be given to this branch of it. A good system of bookkeeping enables the management to see which classes of service are the most delinquent. Some exchanges send no collector and render no statements to residence telephones unless they are considerably in arrears. Comparison of the percentage of arrears where collectors go to residences and where they do not go to the residences show practically no difference. The sending of a collector to residence telephones costs a company more than the other plan. For the guidance of the collection department the company should establish a rule not allowing arrearage to exceed a certain time. Subscribers who get in arrears should be called on by collector, mailed a statement or talked with by telephone. When all other means fail and the account is past the time allowed, a formal written notice should be sent advising the subscriber that if his account is not paid by a certain date the service will be discontinued. Unless satisfactory arrangements are made, the service should be discontinued promptly on the date set. Single lines should be discontinued by putting a nonpayment plug in the answering jack, thus allowing other people to call the subscriber but whenever the subscriber tries to call out the operator gives him the collection department. This is a much better way than disconnecting the line and usually gets quick results. In the case of party lines the drops are disconnected from the line wires. If account is not paid within a reasonable time after disconnection the phone should be taken out.

In making collections it is necessary to put in plenty of good hard work mixed with tact and diplomacy, as an iron-bound, inflexible collection system will lose accounts and subscribers, when good common sense would have gotten the account and kept the subscriber.

SHOPPING BY TELEPHONE.

ANOTHER new use for the telephone has been found, says an exchange. This time it is for the man of the house, not the telephone companies, to complain. It behooves him to spend a day at home and he will hear a conversation something like the following:

"Yes, this is Mrs. West Grand Avenue."

"Oh, yes Batiste; I didn't recognize your voice."

"How lovely! I would like to have it, but really, I just can't. I'm afraid to think of those gowns I got the other day, though they are too dear for anything."

"Just my size? Shell pink, you say? Well, perhaps I will come down. It will not hurt to look at it anyway. All right; I know I oughtn't to but I will be down this afternoon. Please put it aside until I can see it."

A saleswoman in the employ of one of the most fashionable stores explained that she sells most of the finest goods by telephone. She knows just what her best customers like and as new goods come in she circulates the "tip." Her best sales are made in this way.

Long Distance Telephone Exchange Equipment

GENERAL DISCUSSION OF A CENTRAL OFFICE INSTALLATION FOR LONG DISTANCE TELEPHONE AND TELEGRAPH SERVICE

By Chas. F. Saenger

[Third installment. The second installment appeared in the July TELEPHONY.]

PHOTOGRAPHS of the toll board and toll room before and after the cut over are shown in Figures 18 and 19.

The recording board has an ultimate multiple capacity of eighty recording trunks with sixty equipped; one hundred and twenty service trunks; eighty office trunks, and forty long distance terminal trunks. As stated before, the recording trunks are multiplied at each of the common sections, the calling signals being switches from one to the other by locking plunger keys which are mounted on the first position of the recording board, directly under the corresponding answering jack.

On the recording board the recording trunks are multiplied at each position so that the signals will appear on all positions and can be answered by any one of the operators sitting at the board. Of the recording trunks ten are provided with green caps and are used for all connections or calls from pay stations. All calls taken over these trunks are stamped "pay station" by the operator when the call is taken. Two trunks are provided with blue caps and are used for all calls coming from subscribers' stations, for some reason not entitled to long distance service. The recording operator receiving a call over one of these trunks immediately refers it to the information operator for disposition, unless she has the necessary information at hand which will enable her to dispose of it without reference. Figure 20 shows the circuit arrangement of the recording trunks. The calling or locking relay, was changed to a combination of two relays the same as in the case of the toll line circuit. For the sake of uniformity as well as other advantageous features all trunks with the exception of the wire chief's outgoing trunks were arranged for and equipped with ring down signals. The writer believes this method preferable to that of simply plugging into the jack and depending upon an extra contact in the jack or cord circuit to operate the calling signal apparatus. It is not necessary to instruct operators, nor for them to remember or bear in mind that when calling over a service trunk or toll line they must ring and when calling over an interposition or office trunk she must not ring but simply plug into the jack. This also holds good in case of the "A" operator on the local board. She calls long distance in the same manner as she would a local subscriber. Each position of the recording board is equipped with six pairs of cords. Figure 21 shows the circuit arrangement. It will be noted that it is not necessary for the operator to throw the listening key when answering calls, the operator's set

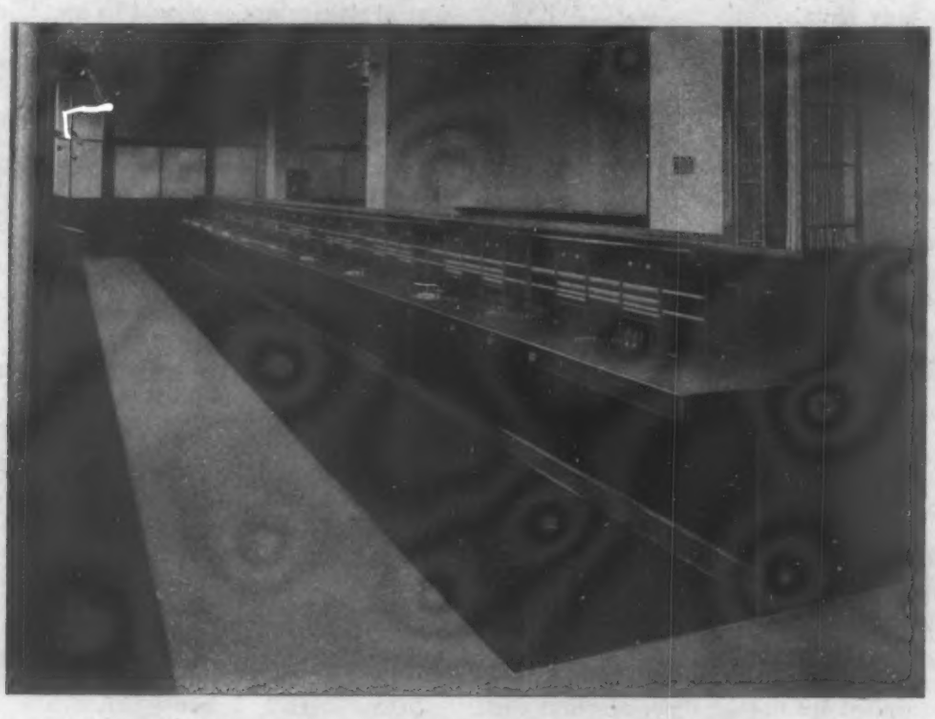


Figure 18.—Toll room before the cut-over.

being normally bridged across the circuit. The key is used for ringing and cutting off the operators set when a connection is established over a service or office trunk. The positions are also provided with order wire circuit for direct communication with the "B" positions, messenger call circuit, and the position circuit. Figure 4 shows the

There is also a messenger call circuit, which is operated by a locking plunger key mounted in the jack panel, and a night alarm and pilot circuit connected with a buzzer for the purpose of attracting attention when the chief assistant is patroling the board.

The assistant chief operator's side is equipped with a mul-

Figure 19.—Toll room after the cut-over.

arrangement of the apparatus on the key board and jack panels.

Figure 22 is a photograph of the recording sections.

Figure 23 is a photograph of the chief operator's and assistant chief operator's desk. The chief operator's side of this desk is provided with five incoming and five out-

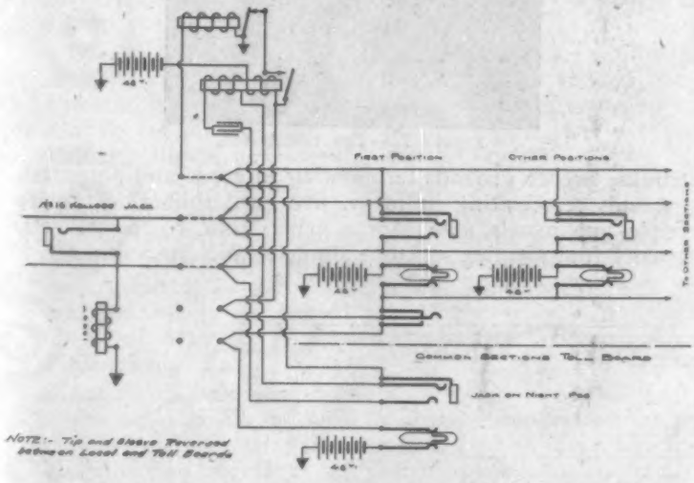


Figure 20.—Circuit arrangement of recording trunks.

going trunks, forty listening taps connected to the tertiary winding of the induction coil of the operator's set for monitoring, and forty talking taps connected to the secondary winding for direct communication with the operators. The incoming and outgoing trunks terminate in keys. The operator's set is equipped with a desk stand with switching keys, receiver and head band instead of the breast plate type.

tiple of the chief operator's incoming and outgoing trunks ending in jacks, and a full multiple of the toll lines minus the busy signals, four pairs of cord circuits, a messenger call circuit and breast plate type operator's set.

Figure 24 shows the circuit arrangement of the operator's set for this desk. It will be noted that the transmitter cut-out key is used when monitoring connections instead of cut-

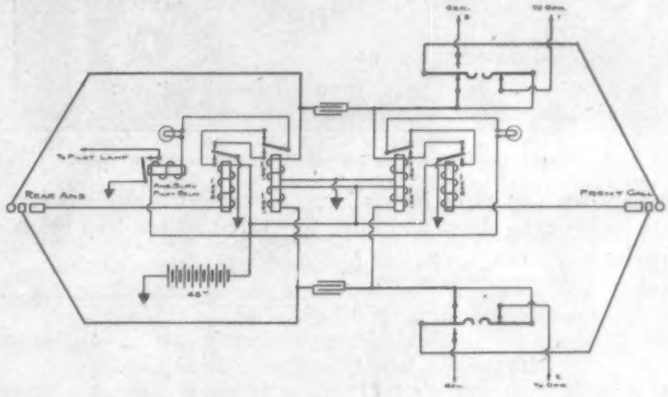


Figure 21.—Recording operator's cord circuits.

ting out the secondary winding of the induction coil and substituting a resistance coil, as is the case in the sets used on the toll board.

Figure 25 is the floor plan arrangement of the toll room on the eighth floor, and shows the location of the toll board, recording board, chief and assistant chief operator's desk, supervisory sets, messenger call box, and the cable ducts carrying local circuit cables from one to the other.

Figure 26 is a photograph of the test board which is lo-

cated in the wire chief's room, and to which all toll lines are brought before reaching the toll board. This test board is

Figure 22.—The recording board.

probably the largest and most completely equipped test board in the Independent field today. The cabinet is approxi-

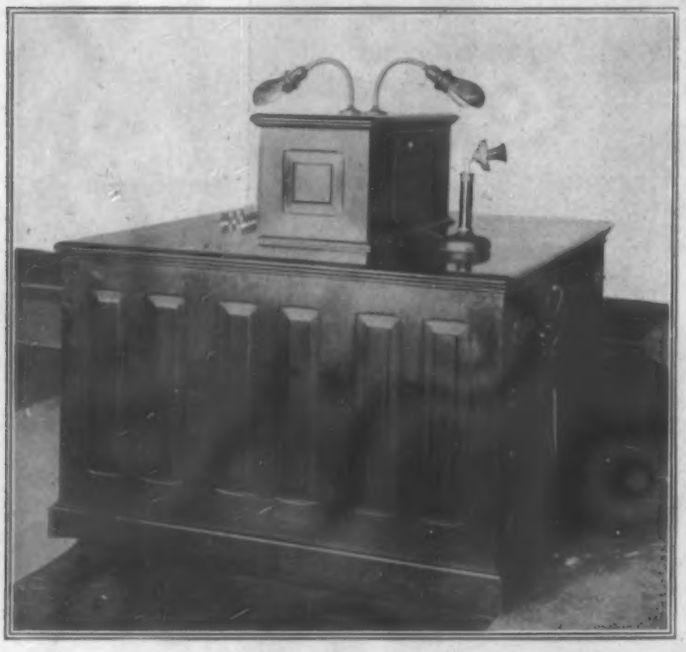


Figure 23.—Chief and assistant chief operators' desk.

mately ten feet three inches long, seven feet high, two feet six inches deep above and three feet three inches deep below the key board. The key board is twenty-one inches wide, including the plug shelf and and is three feet four inches from the floor. This board has an ultimate capacity for

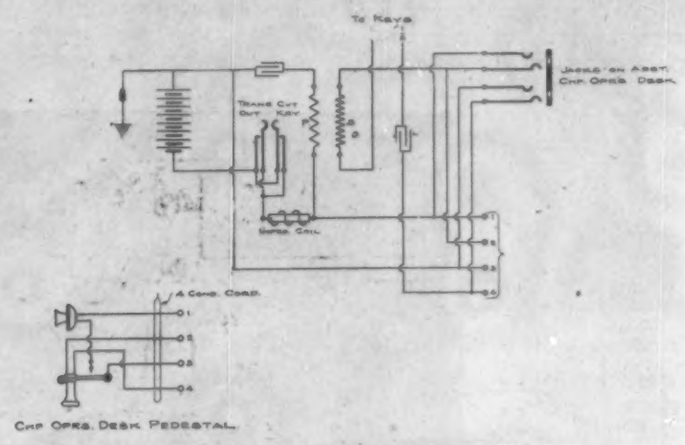


Figure 24.—Chief operator's circuit.

one hundred and sixty toll lines, forty telegraph or Morse loops, twenty sets of automatic telegraph repeaters, eighty battery taps, eighty composite and simplex sets, and eighty Morse legs. It is equipped with eight Morse testing sets, three telephone or operators' sets, one universal type bridge and galvanometer testing set, five incoming and five outgoing

Figure 26.—The test board.

trunks, twenty grounds terminating in cords and plugs, ten grounds terminating in jacks, five hard rubber forty-wire triple line panels, one Morse panel, four composite sets, twenty-four simplex sets, one ammeter and one voltmeter.

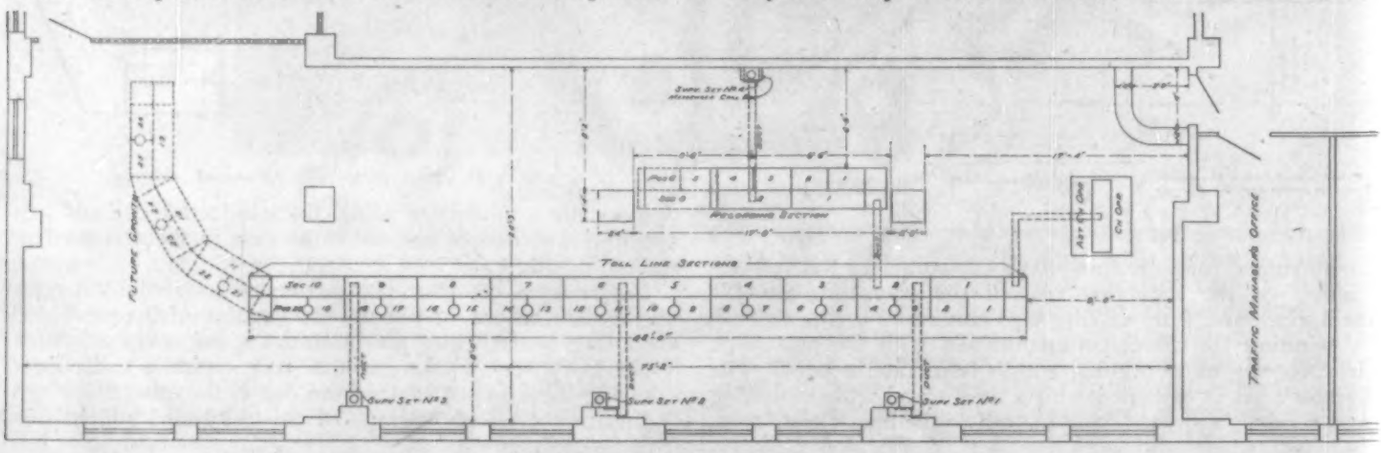


Figure 25.—Floor plan of toll room.

Digest of Telephone Patents

By Edward E. Clement

893,820. Intercommunicating Telephones. Thomson. It is stated that junction boxes are usually employed in systems of this kind but Mr. Thomson uses a terminal rack on the back board. Application filed March 20, 1907. Patent assigned to Electric Goods Manufacturing Company of Boston.

893,891. Hand Telephone Set. Atwood. Water proof combination set of the well known Swedish type. Application filed March 12, 1906. Patent assigned to Western Electric Company.

893,953. Telephone Relay. Underwood. Refers to prior application, serial No. 382,475, filed July 6, 1907. Claims a mechanical transmitting means between the receiver and transmitter elements of the relay. Application filed February 6, 1908. Patent unassigned.

894,170. Telephone Repeater System. Warth. Two-way telephone repeaters having duplicate elements working both ways. Application filed April 22, 1907. Patent unassigned.

894,257. Telephone Apparatus. Cobb. Operator's telephone provided with straps for the head and chin and an adjustable transmitter. Application filed November 4, 1907. Patent unassigned.

894,258. Telephone Apparatus. Cobb. Improvement in operator's telephone involving the same members as 894,257. Application filed January 18, 1908. Patent unassigned.

894,460. Telephone Transmitter. Pitrat. Keeps transmitter button vertical by setting it with its axis parallel to the pivot. Application filed June 21, 1907. Patent unassigned.

894,705. Protective Device. Schattner. Magnetite shunt placed across a line in the event of a sudden rise in potential heats up and ensures the passage of sufficient current to cut out the line. Application filed June 10, 1905. Patent assigned to General Electric Company.

894,836. Receiving Telegraphic and Telephonic Impulses Simultaneously. Kitsee. Telegraphic relay and telephonic receiver connected for simultaneous action. The relay is included in the line, and the receiver is in the secondary circuit of a coil whose primary in series with several condensers is shunted around the relay. Application filed June 21, 1906. Assigned one-half to William J. Latta, Philadelphia, Pa.

895,166. Telephone System. Dean. Common battery telephone system employing connective supervisory signals that are visible during conversation and extinguished upon disconnection, together with positive pilot relay giving a reverse signal. Application filed December 22, 1902. Patent assigned to Kellogg Switchboard & Supply Company.

895,320. Telephone Directory. Wilt. Sheet metal telephone directory with punched openings to show numbers on card, the corresponding names such as Fire, Police, Doctor, etc., being carried on the frame. Application filed July 24, 1906. Patent unassigned.

895,431. Inclosed Fuse. Cole. An inclosed fuse having its vent holes covered with a screen of fuzzy filaments or threads, to retain the filling material when the fuse blows. Application filed January 31, 1907. Patent assigned to the Johns-Pratt Company, of Hartford, Conn.

895,432. Inclosed Fuse Terminal. Cole. An inclosed fuse having its end cap and contact blade riveted together. Application filed February 16, 1907. Patent assigned to the Johns-Pratt Company of Hartford, Conn.

895,443. Coin Box for Telephones. Ellis. Coin box having a permanent register actuated when succeeding user pushes the last coin through, arranged so that the coin closes the signal circuit. Application filed September 6, 1904. Patent assigned to American Coin Register Company.

895,536. Supporter for Books, Telephones, and the Like. Benson. An adjustable swinging arm adapted to carry an entire desk set, a book or the like. Application filed October 26, 1905. Patent unassigned.

895,695. Support for Telephone Receivers. Simons. Bent wire yoke is clamped to the transmitter arm, and carries the cradle at its forward end for the receiver. Application filed October 1, 1906. Patent unassigned.

895,777. Coin Operated Attachment for Pay Telephone. Lonergan. Coin box of the type in which the coin when deposited furnishes an abutment for the gong mechanism to signal the operator. Application filed February 19, 1908. Patent unassigned.

895,833. Telephone Support. Aungst. Swinging desk arm having a vertical standard clamped to the edge of the desk, and a telescoping horizontal member having a spider at its outer end to take the base of the desk set. Application filed May 10, 1907. Patent unassigned.

895,834. Supporting Device for Portable Telephones. Aungst. A similar vertical standard and clamp carries a swinging arm with pivoted extension, the device sliding up and down on the standard and gripping the same to hold it in place. Application filed October 14, 1907. Patent unassigned.

895,977. Combined Fuse Box and Cut-Out Switch. Dawber. Fuses are contained within a rectangular space in a porcelain base separated by a diamond shaped projection, to which are fitted similar shaped ribs on the cover when in place. A second lidless compartment contains brass terminals, one of each pair being an arc and the other a base on which the connecting button is secured. Application filed June 26, 1907. Patent unassigned.

895,978. Apparatus for Transmitting and Reproducing Sounds. Dearlove. This is a multiple microphone adapted for use under water. Not only is it moisture proof but adapted to resist pressure. Application filed January 30, 1905. Patent unassigned.

896,081. Telephone Call Register. Brockway. A call register for telephone systems carried in and secured to a transmitter shell so as to communicate directly with the back of the diaphragm, the arm operating the register being extended through the shell. Application filed March 30, 1906. Patent assigned to Dean Electric Company.

A Fight With an Octopus

By Paul Latzke

The Story of the Bell Company's Rise to a Power that was second only to that of the Standard Oil Company—The Betrayal of Friends and Associates, The Sacrifice of Great National Characters and the Desperate Purpose of a Fight that was Carried Straight into the White House.

A FOREWORD.

[This story should appeal especially to those who have good, red American blood in their veins. It is the story of a magnificent fight that was won against overwhelming odds. It is the story of a smug coterie of "Boston gentlemen" of the immaculate type, put to flight by a few sturdy men out of the west. It is the story of a low, scheming campaign of greed, that was turned into a rout by a fine, sentimental, American citizenship. It is a story full of dramatic interest, not because of the manner of telling, which is simple and commonplace enough, but because of the facts it relates.

It is the story of at least one trust that was "busted." It is a story that, while dealing with the details of an industrial war, will interest even the women, for it is full of good, clean, honest fighting, of the deeds of men who stood shoulder to shoulder under the Stars and Stripes, and, in the name of American freedom and independence, lined up against the most complete and relentless and successful monopoly of the times—and beat it to a pulp. It is a poor sort either of man or woman who cannot find somewhere in the record of these fighters the story of a deed that will stir the pulse.—THE AUTHOR.]

CHAPTER XIX.

A RECKLESS WASTE OF MONEY.

ONLY the inner circle, at Bell headquarters in Boston, knows what its press campaign has cost. It must show a fabulous total. A single month's work in such a small place as Evansville, Indiana, it was shown, cost the Cumberland Telephone Company, one of the Bell subsidiaries, over $11,500, divided between the two local dailies. One of these, the "Journal News," finally revolted, under pressure of local merchants, who threatened to withdraw their patronage. In an editorial published March 9, 1904, it announced its reformation and told all the facts connected with the sale of its columns and the columns of its contemporary. But such incidents as these have no effect on the activities of the Bell press bureau and the disbursement of its great corruption fund. For more than twelve years it has been in active operation, and there is hardly a city, town, or hamlet that has not been "worked."

In New England hundreds of newspapers of the second class have tied themselves to the Bell, hand and foot, under regular contracts which contain, among others, these two clauses:

"1.—The party of the first part (the newspaper,) . . . . hereby agrees . . . . to furnish whenever called upon to do so by the second party (the New England Bell Company), a three-inch space, single column, ... for such advertising *or other matter* as second party may desire. . . . .

"3.—It is further understood that said first party (the newspaper,) *will at all times exercise its good will in said second party's interest and co-operate with said second party.* . . . . ."

What becomes of the chief safeguard of our liberties, a free press, when newspaper owners are found eagerly willing to sign away their consciences like this?

In Omaha, a strong Independent company backed with plenty of local capital, applied for a franchise. The company guaranteed valuable returns to the city, low rates to the subscribers, and high-grade service. It promised to free the people from the take-it-or-leave-it policy prevailing here as elsewhere. Immediately the local papers began to publish "letters from our special correspondent," dated, apparently, at St. Joseph, Kansas City, Louisville, St. Louis, and other cities where Independent plants were operating in opposition to the Bell. These letters told with harrowing detail the loss and annoyance the people in these places were suffering, and how anxious they were to be rid of the Independent plants. These letters were anywhere from a column and one-half to three columns long, and appeared under some such headlines as these, which are taken from the Omaha "Bee":

"'PHONE TROUBLES IN ST. JOE.
BY TWO SYSTEMS OF WIRE TALKING THEY ARE MULTIPLIED.

INTERESTING SIDE LIGHTS ON THE TELEPHONE SITUATION IN A THRIVING MISSOURI TOWN."

The good people of Omaha who read these "letters" did not, of course, dream that they were simply the paid advertisements of the Bell company, though their suspicions should have been aroused when the "World-Herald" printed a lot of similar "letters." Any novice might have seen that these were written by the same gifted hand. The "News," published in the same city, was retained to work along somewhat different lines. It published matter showing what the people might expect in the way of poor service, one article appearing under these head-lines:

"INDEPENDENT 'PHONES HAVE LIGHT WIRES.
IT IS IMPOSSIBLE TO SECURE SATISFACTORY SERVICE FOR LONG DISTANCE WITHOUT COPPER METALLIC SERVICE."

In the space at my disposal I shall content myself with reference to one other incident that illustrates the workings of the remarkable press bureau maintained by the Bell.

On April 10, 1905, the New York "Tribune" printed on its first page what appeared to be a special dispatch from Sioux City, Iowa, occupying something over a column of space. It was headed:

"BELL TELEPHONE COMPANY FORCED TO SURRENDER.
FARMERS OF IOWA WIN THEIR TWENTY YEARS' FIGHT AGAINST THE MONOPOLY."

Here was surely an attack on the Bell Telephone Company. It began by stating that "The American Bell Telephone Company, for twenty years the most haughty and uncompromising monopoly in America, has been forced by the farmers of Iowa to an unconditional surrender."

In the years that I have followed the telephone fight I have made a special study of the Bell company's press work. Naturally this should make me reasonably expert in picking out material disguised as news matter that has been run "at reading-notice rates." But in this instance, I, myself, was completely taken in, until my attention was specially called to certain peculiarities about the article, by the manager of an Independent plant in New Jersey.

Still I couldn't make out what object the Bell Telephone Company could hope to attain by the publication of such matter.

"Why," declared my Jersey friend, "that's as clear as day. They are trying to lull the suspicion of the farmer by having it appear that they have been beaten and that they have thrown up their hands. They are seeking to create a condition of mind that will make the farmer believe it is now perfectly safe to tie up to the tamed monopoly. I happen to have had personal experience of the way this article is working. It was reproduced in the weekly and tri-weekly issues of the 'Tribune,' which have probably as large circulations among farmers as any publication in the United States. One of the farmers down my way, who represents a co-operative company with which I am negotiating a traffic arrangement, showed this article to me as a complete refutation of my statement that it was dangerous for the farmers to ally themselves with the Bell under any circumstances, because the monopoly would in the end swallow them up."

Two paragraphs in the article, on close study, revealed the "nigger in the woodpile" clearly enough. One of these paragraphs reads: "This means that, in the end, all lines and exchanges must be connected; the two systems will be, for every purpose of physical operation, merged into one. It will mean, in the end, that two systems can not be maintained side by side."

That is the stereotyped matter sent out from Boston day in and day out, from year's beginning to year's end, only this time it was approached from the other direction.

A little further along occurred the other paragraph which gave the key to the motive. This paragraph read:

"In Iowa, it is true, the (Bell) company has been defeated, but that has been accomplished only by peculiar local conditions. The farmers of Iowa won the victory with their rural lines. The Bell people still have their powerful position, their immensely valuable business in other states. They are still strong in legislatures and with congress; they are still able to buy every promising improvement, every device protected by patent that is offered to them."

Not long after my attention had been called to this article its fruits began to appear. From a hundred small country papers came clippings summarizing the "Tribune" story. These summaries were, as usual with the Bell press work, exactly alike even in the matter of punctuation; they wound up with this paragraph:

"The result will be that the latter (the Bell Telephone Company,) will now permit connection to be made between its instruments and those of the other companies (the Independents), and it will no longer be necessary for anybody to rent two telephones from antagonistic establishments."

It was the siren's song with which the monopoly hoped to lull the fears of its opponents in the backwoods districts so that they would yield themselves to its protection and friendly assimilation. One of the telephone periodicals put it thus, in commenting on this stroke of literary genius:

"Could anything be much 'smarter' than that? It will no longer be necessary for anybody to rent two telephones from antagonistic establishments. 'Come right into our parlor, Mr. Farmer; we're harmless now.' Where is the 'green goods' circular that can touch this precious document for clean-cut knavery?"

BIG INDEPENDENT MERGER.

THE American Union Telephone Company, with headquarters at Harrisburg, Pa., has absorbed the Consolidated Telephone Companies of Pennsylvania, with headquarters in Allentown.

Forty-seven exchanges, controlling eight counties, are operated by the Consolidated Companies—Lackawanna, Luzerne, Carbon, Northampton, Lehigh, Berks, Montgomery and Bucks, as well as the territory in New Jersey east of the Delaware River from Belvidere to Trenton. The principal exchanges are at Allentown, Carbondale, Scranton, Wilkesbarre, Hazleton, Mauch Chunk, Slatington, Bethlehem, Easton and Reading. In the Consolidated system are more than twenty thousand telephones and nearly ten thousand miles of toll circuits.

The American Union is the largest Independent telephone company in America. The consolidation makes it one of the largest systems in the world. With the Consolidated system under its ownership, the American Union now has 234 exchanges, with sixty-five thousand subscribers, extending over the entire state of Pennsylvania and into Ohio, Maryland, Virginia, West Virginia, New York, New Jersey and Delaware.

Where the aggregated gross revenue of both companies in 1907 was $1,378,460, with net earnings of $660,017, the current year is expected to produce considerably more than $1,500,000 of gross income.

At a meeting held for the purpose at the offices of the Consolidated Companies, in Allentown, all the officers and directors of that organization retired, and the following were elected in their places: President, Ellis L. Orris, Bellefonte; vice president, F. D. Houck, Harrisburg; secretary and treasurer, S. R. Caldwell, Harrisburg. The directors elected were: Mr. Orvis, Mr. Houck and the following: S. P. Light, Lebanon; Lyman D. Gilbert, William Jennings, B. F. Meyers, Harrisburg; James R. Krause, Williamsport; James Kerr, Clearfield; J. L. Spangler, Bellefonte; Charles West, Allentown; Timothy S. Clark, Williamsport; Asburg W. Lee, Clearfield.

Among the other members of the American Union are John W. Garland, president of the Garland Corporation, of Pittsburg; W. R. Trast, of Erie, vice president of the Marine Merchants' Bank and president of Trast, Prescott & Co.; William Kaul, banker and capitalist, of St. Mary's; B. Dawson Coleman, president of the First National Bank of Lebanon and president of the Lebanon County Trust Company, and Rembrandt Peale, president of Peale, Peacock & Kerr, coal operators, of New York city.

Before absorbing the Consolidated, the American Union had more than five thousand security holders. This is now increased by several thousand. The company is capitalized at $25,000,000 stock and $25,000,000 of bonds. Of the stock, $10,000,000 is six per cent preferred and $15,000,000 is common. Of this, there was outstanding before the present consolidation, $2,000,000 of preferred and a like amount of common.

Owners of Consolidated securities will receive for each $100 at par of the capital stock of the Consolidated companies twenty per cent at par of the capital stock of the American Union Company, half in preferred and half in common. For bonds they are to receive in exchange at par sixty per cent of the first mortgage bonds of the American Union Company, in addition to fifteen per cent in preferred and twenty-five per cent in common stock.

The deal was financed through the Lehigh Valley Trust and Safe Deposit Company, of Allentown; the Wyoming Valley Trust Company, of Wilkesbarre, and the Markle Banking and Trust Company, of Hazleton.

REMODELING AN OLD EXCHANGE

The First Installment of a Practical and Instructive Article on a Subject of Considerable Importance

By L. W. Carroll

WHERE is probably no better way of illustrating what may be done with a run-down and overloaded telephone system than to relate an experience with a country telephone system which consisted of two exchanges located about twelve miles apart, each having about four hundred local and three hundred rural telephones. In addition there were toll lines connecting with nine toll stations, nearly all of which consisted of rural switchboards. These switchboards were owned and operated on the mutual plan, by farmers, there being from fifty to one hundred and fifty subscribers connected with each switchboard.

The two exchanges were common battery, common return systems using forty-volt battery with visual signal non-multiple switchboards on which the sleeves of all line jacks were permanently tied to the ground side of the battery. Of this last feature further mention will be made later.

About three thousand feet of one hundred pair aerial cable had been put up, of which one side of each pair was grounded at the cable boxes to the common return of the

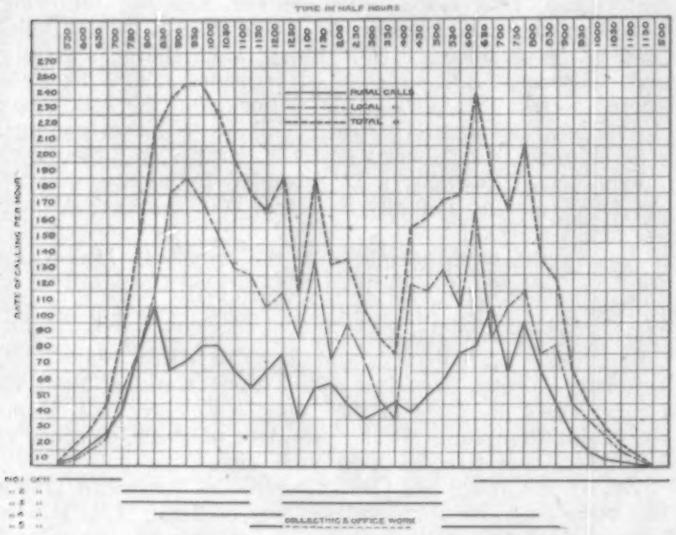


Chart showing peg count and operating arrangement.

system, the other side of the pair being connected to the line wire by a single jumper.

The writer having assumed the duties of superintendent and manager of the system a thorough inspection was made of the inside and outside construction of both exchanges and suggestions made for the elimination of all evident liability of trouble.

At the home office a look at the wiring on the key-shelves of the local and rural operators' positions was enough to make the wrath of man rise up and overflow in a manner characteristic only of the conscientious telephone man. There were from one to three loose connections at every key where some overzealous "bug-hunter" had unsoldered to make a test and failed to resolder or had tried to resolder with acid. These were properly soldered the first night, as well as about two hundred loose cross connections which seemed to dance as the terminal frames were jarred. In addition to this all loose line jumpers on the terminal poles were soldered by the trouble men within the next few days, during their spare time. As no record was kept of the intermittent trouble, such as noisy lines, swinging grounds and bad cords, it would be difficult to say just how much trouble was eliminated by the soldering of the loose connections. The operators were instructed to make a note of all cases of intermittent trouble, and it was found that out of four hundred local lines there were over sixty swinging grounds, some showing up with wind in one direction, others with the wind in another direction. On investigation, it was found that nearly thirty per cent of these were caused by carelessness in stringing drop-wires too close to foreign lines and guys which were grounded, a practice which not only causes poor service for the company owning the wires but also breeds trouble with the owners of the foreign lines. The balance of this trouble was due to lines passing through trees, or slack in the various leads.

As soon as a swinging ground was reported a trouble man was immediately sent over the line, and a permanent repair made if possible. If permanent repair was not possible at this time the trouble was cleared, and a report made as to the existing conditions in order that the fault could be taken care of by a general overhauling.

On the switchboard there were only one or two sets of cords, of which the answering or calling cords were not noisy. This was taken care of by cutting back such of the old cords as could be repaired, and ordering new cords for the balance. The operators' receivers were also in bad condition, owing to bad cords and to having the diaphragms dented; this being caused by careless handling and throwing them down on the keyboard. New cords and diaphragms fixed this trouble. It might be well to say here that trouble in an operator's telephone set should be taken care of in preference to nearly every other trouble which a telephone switchboard is heir to, as it not only affects every call that comes in to that operator, but wears on the patience of the operator as well as that of the subscriber.

Next in importance is cord circuit trouble, as one or two bad cords will affect the service of countless numbers of patrons during a day, both the calling and called parties being affected thereby. The writer has found it a very simple matter to provide the operator with a jack for testing out the switchboard cord circuits. In case the switchboard is of the magneto type, a very satisfactory test may be made by bridging a couple of dry batteries across the line springs of a vacant spring jack from which the drop has been disconnected. If the switchboard is a common batery type the dry cells may be replaced by an impedance coil of about thirty ohms resistance, the same being bridged across the line terminals as in case of the battery.

The operator first opens her listening key on the cord circuit to be tested, and plugs into the test jack; giving the cord a rotating movement, a scratching noise will indicate that the cord is bad. The other cord of the pair is then tested in the same way, the same method being repeated with the rest of the cord circuits. As this test was made each day the cords were always in good condition.

A considerable saving in the wear on switchboard cords may be made by insisting that the operators grasp the plug

instead of the cord in putting up and taking down connections.

It is highly important that the operators should be properly educated as to the use of the apparatus on the switchboard, especially the use of repeating coils in a toll cord circuit. An instance of the improper use of repeating coils was found in the inspection of a toll office doing a toll business of two thousand dollars a month where the operators used repeating coils on all connections, including the through toll switching of terminating long-distance lines. As the average repeating coil has an efficiency of only about sixty per cent, they should not be used except where a metallic circuit is connected to a grounded line or a line which is in trouble.

Another rather exceptional use of a repeating coil was found where the rural operator complained that one of the grounded rural lines could not talk with any other line unless a cord circuit containing a repeating coil was used. On investigation, it was found that this particular line was connected to a switchboard pair which happened to have the line wires reversed. Of course when a connection was made to another grounded line the tip of one cord and the sleeve of the other cord of the pair was grounded, thus short-circuiting both lines. When a repeating coil was used the front and rear cords were separated, and satisfactory operation secured. It may be assumed that no time was lost in reversing the switchboard wires.

On looking over the monthly expenses it was found that the light and power bill was thirty-six dollars for lighting and exchange and charging the switchboard battery. Of this amount, six dollars was for lighting the exchange. The switchboard was not equipped with reflectors, but there was a sixteen candle-power drop light hanging just back of each operator and about eight feet from the floor. There were also four thirty-two candle-power drop lights in other parts of the operating room. After sizing up the situation some border brackets were ordered and put on the switchboard, one over each operator's position, and adjusted so that the half reflectors would shade the light from the operators' eyes and direct the light to the face of the switchboard and to the key shelf. Then four candle-power lamps were put in with the result that the switchboard was better lighted at one-fourth of the cost. The four thirty-two candle-power lights were replaced by two thirty-two candle-power lights with ceiling reflectors, which gave sufficient light, as a high illumination is not necessary in an operating room if the switchboard is properly lighted. Four candle-power lamps were also substituted for sixteen candle-power lamps on the power board with no great inconvenience and a seventy-five per cent saving.

The next move was to cut the switchboard battery from forty volts to twenty, which was accomplished by changing the supervisory signals from forty to twenty volt lamps and the impedance coils in the cord circuit from four hundred ohms to two hundred. This cut down the battery consumption on the switchboard fifty per cent and the loss in leakage seventy-five per cent. The leakage is considerable on a forty-volt system; for illustration, on this exchange in damp weather the leakage current was, at times, one-fourth ampere at forty volts; which, for twenty-four hours, gives two hundred and forty watt-hours loss. When the voltage was reduced to twenty the leakage current was one-eighth ampere, which gave only sixty watt-hours loss in twenty-four hours.

This also gave the exchange a reserve battery which is of considerable advantage in towns where there is only one source of power, as both batteries may be kept charged for use in case of an emergency. Care should be taken that each battery gets its share of work, as a considerable decrease in efficiency will result if a battery is allowed to remain idle for some time. While the cost of charging the switchboard batteries was reduced fifty per cent it was decided that it could be still further reduced by the use of a gasoline engine. A small one and one-half horse-power, two-cycle engine was purchased on trial, but trouble with the insurance company was encountered and the engine had to be returned. A one and one-half horse-power kerosene engine was then purchased and installed. This gave entire satisfaction after the speed was reduced from eight hundred revolutions per minute to five hundred; this bringing the engine down to about three-fourths horse-power, which was sufficient to pull the charging generator at full load.

An engine for charging need only be large enough to pull the load when the batteries are fully charged, and may be a two-cycle type, as these engines give excellent regulation and run very smoothly where the load is practically constant, as in the case of running charging sets. It has been the experience of the writer that the load on a gasoline engine should equal seventy-five per cent or more of the rated horse-power of the engine to get good economy and close regulation, as the governors on the average gasoline or kerosene engines will not give close regulation when running at one-fourth or one-half full load.

For a machine pier a slab of stone five feet by two and one-half feet, and six inches thick, was secured. On one end of this the old charging set, consisting of an alternating current motor direct connected to a generator, was mounted, the engine being placed on the other end. A plank box ten inches deep and two inches larger each way than the stone base was made and filled with sand. The stone base was placed on the sand, so there was a margin of one inch between the sides of the base and the inside edges of the box. This was done to deaden the vibrations and sound made by the engine and charging machines. It was necessary to take this precaution, as the exchange was located on the second floor over a clothing store. The above arrangement is very successful in deadening sound and vibration in places where it is not possible to place the machines on the ground floor or a solid foundation.

A pulley for belting up with engine was made to take the place of the connecting collar on the generator, it being only the work of a few minutes to change from one power to the other.

Accurate account was kept of the cost of oil and lubricants for one month, and the total was four dollars and twenty-five cents. A similar engine was ordered for the other exchange of the company, and at the end of the year a net saving in the power bill of nearly six hundred dollars was shown, with the additional advantage of having two sources of power in case of emergency.

Shortly after having placed the kerosene engine in operation the electric light and power company decided to change its system from one hundred and thirty-three to sixty-cycle alternating current, which would necessitate our changing the charging motor accordingly. It was found that the old motor could be disposed of for about one-half what a new sixty-cycle motor would cost.

At this time the mercury-arc rectifier for charging storage batteries was just being put on the market, and after consulting with the manufacturers we were advised that while they had not put out a sixty-cycle, one hundred and fifteen volt rectifier for charging at as low as twenty volts, it was thought possible to build one. An order for one was given, and in due time it was received and installed. On being tested out it was found that the secondary voltage was a trifle high, which caused an abnormally high charging current. This, however, was remedied by building up an impedance coil out of two hundred turns of number sixteen cotton-covered magnet wire on a core one and one-half inches in diameter and six inches long made from a bundle of soft iron wire. This was placed in series with the compensating reactance furnished by the manufacturer.

Rectifier charging sets are now on the market which are

especially adapted to charging storage batteries for telephone plants, having means for conveniently varying the reactance which regulates the secondary voltage and charging current. The rectifier gave an efficiency of sixty per cent, which compares very favorably with the average direct connected alternating current charging sets under two horse-power. While we used the rectifier only as a secondary source of power, we found that it gave entire satisfaction with continued use.

In a general observation of the traffic on the switchboard it was noticed that there seemed to be an insufficient number of operators at times to properly handle the calls. A peg count was ordered taken for a week and a curve constructed as shown in the illustration, from which it was found that the number of operators was not at any time in accordance with the operating load, there being, at times, too many operators, and again not enough. There was also a very poor working schedule of hours for some of the operators; for illustration, one operator was required to put in three hours in the morning, two in the afternoon, and two in the evening. This was rearranged, according to the lines at the bottom of the illustration, with the same number of operators, so that each operator worked nine hours, which was divided into two consecutive periods by an intermission for meals. Managers would do well to have more consideration for the comfort of the operators, as anything that may be done which will make their work easier will be more than paid for by better service given. The manager should therefore, whenever possible, arrange the schedule so that the operator's time will not be dragged out into a fifteen or sixteen hour day.

In speaking of operators, the writer believes that nothing gives the patron of a telephone company an impression of poor service more than inefficient and careless operators. There is nothing that will make an operator take interest and pride in the work which is intrusted to her more than impressing her with the necessity of punctuality on her part, and good discipline. It is advisable in small offices, where a chief operator is not needed, to give some regular operator charge of the rest of the force, in order that any difficulties or disputes between other operators may be quickly settled without any interruption of the service.

Considerable trouble was experienced by the corroding and rusting off of the line wires, and upon inquiry it was found that this had been prevalent since the exchange was first put into service. It was self-evident that the trouble was caused by the negative side of the battery being grounded, causing the current to flow from line to ground at any place where the line touched a tree. This caused an electrolytic action to be set up between acids in the sap of the tree and the galvanizing on the wire; with the result that, due to the direction of the current, the coating was taken off the wire, which soon rusted and corroded in two. This action is identical with that on the anode in an electroplating battery.

[To be continued.]

ELECTRIC CAR DISPATCHING.

THE Los Angeles, Cal., electric railways have brought the system of dispatching to the highest stage of perfection.

In the office of the dispatchers of the Los Angeles Railway, from 5 o'clock in the morning, when the first car goes out, until 3:15 the next morning, when the last coach has entered the barns, a dispatcher is on hand, the representative of official authority, in close touch with every point on the system.

Unlike the dispatcher on the big steam lines, the man who handles the city street cars has no long single tracks to figure on passing trains over in opposite directions. On the other hand, he has a position fully as difficult and exacting. No knowledge of telegraphy is needed. To use that in city work would be out of the question, and until the telephone came to the aid, it was little indeed that any one could do to keep track of the cars. Generally they were simply started and run on the judgment of the conductor whenever emergencies overthrew the routine.

At least two men are on duty all the time, and during rush hours, from 6 to 10 a. m. and from 4 to 6 p. m., there are three. Each has a desk on which is placed a large sheet. A portion of this is given to each route. Here, in parallel columns, is noted the number of every car, the name of conductor and motorman, and the exact schedule of every run.

Private telephone wires reach wherever the cars go. At convenient points, one always at every terminal, are seventy-two private telephone boxes, besides which the office has connection with the regular telephone service with an operator to take any emergency or other call coming in this way. To have his hands entirely free each dispatcher wears the headpiece employed by telephone operators. The minute a conductor takes down the receiver a tiny red light appears on the switchboard. Instantly the dispatcher pulls down a little lever and connection is made. "Hello," he says. Then the conductor gives his name, car number, and any other information to be communicated.

Should a car be delayed more than three minutes, the passengers will, if circumstances permit, be transferred to another at the first crossover and the car sent back, so to get the schedule straightened. When a delay arises the conductor must, if possible, report at once, but if it occurs too far from a telephone and close to a crossover the carmen act on their own judgment and report on their return to the original starting point, giving the reason why they did not call up at the regular terminus.

So perfect is the record kept that the company knows the exact number of miles and fractions of a mile traveled by every car during its service and on any day thereof, also every mishap that has befallen it. By this it is easy to determine the wearing and working quality of any style of coach, wheel, brake or gear that may be tried. It is also an aid in making up the record of any employe. It also furnishes a guide to the status of the track, grade or other conditions.

Whenever a breakdown or other trouble occurs, if it can be fixed without going to the barns or tying up traffic, the dispatcher will order a repairer or inspector to attend to it. If a piece of track, switch, crossover or trolley gets out of order, the dispatcher sends a repairer at once or if needed, the repair wagon is hurried out. There are car and track repairers always on the road and they report to the dispatcher every hour so that he can send them where needed.

In case of a blockade the first conductor must report. If it promises to continue long and there is a route around, the dispatcher will order all cars by that line and send assistance, if possible, to aid in removing the obstruction. There is a fire alarm in the office and the location of every conflagration is known as quickly as by the fire department. If cars are stopped particulars are given by the first conductor reporting. If he says cars can pass with the hose bridge the dispatcher orders it sent, transfers cars to another route, or has them use the nearest crossover and double back.

The dispatchers are all promoted from the ranks of the carmen and chosen from those whose records are the best. This is essential, as they must have the map of the entire system constantly in mind, with its crossovers, grades, railroad crossings and the peculiar conditions to be encountered on each street—all things which can only be learned by actual experience. These men are the directors of the system in operation, whose word is final until overruled by the superintendent. Their responsibilities are great and the work exacting and confining, so that it is limited to eight hours daily, the same as on the steam railroads.

TELEPHONE LEGAL DECISIONS

A Compilation of Recent Decisions in Telephone Cases Rendered by the Upper Courts.

By R. R. Rossing.

[Hereafter TELEPHONY intends to report in this department the recent important supreme court decisions affecting telephone companies and telephone affairs. This service will be complete and up to date, including all of the courts of last resort in the United States. Managers and attorneys of telephone companies will find this department a great time-saver, as by glancing over the decisions contained therein they can obtain in ten minutes information of late cases that otherwise would require research and study of law reports covering several days. Following the headline, briefly describing the case, is given the syllabus delivered by the court condensed into few words yet covering the point of law interpreted. The names of the litigants, the name of the court and the volume and page number of the law reports are appended. For the convenience of its readers TELEPHONY has arranged to supply complete decisions of all cases mentioned in the legal digest for a nominal charge.]

PAYMENT OF PERCENTAGE OF GROSS EARNINGS.

WHERE a city council is authorized by law to prevent or regulate the setting or stringing of telephone poles and wires in the city, an ordinance granting a telephone company a right to install and operate a telephone system and plant in the city, subject to certain restrictions and conditions, including a provision that the company should pay the city a certain per cent per annum of its gross earnings after a certain number of revenue earning telephones were in operation, and such ordinance was accepted by the officers of the company upon authorization of a vote of its directors, and the ordinance recites the acceptance of the ordinance by the telephone company in consideration of its passage and other good and valuable considerations, including $1, the receipt of which is acknowledged by the company, the telephone company is bound by the obligation.—*City of Jamestown v. Home Telephone Company, Supreme Court of New York, 109 N. Y. Supp., 297.*

TAXATION ON BUSINESS OUTSIDE CITY.

Under its charter, the city of Lincoln may lawfully enact an ordinance imposing upon telephone companies a business or occupation tax measured by the gross receipts within the city, and the fact that tolls and rentals collected within the city are in part for messages over lines lying in part beyond the city limits does not invalidate the tax. Western Tel. Co. v. Fremont, 39 Neb. 692, 58 N. W. 415, 26 L. R. A. 698.—*Nebraska Telephone Company v. City of Lincoln, Supreme Court of Nebraska, 117 Northwestern, 284.*

TAXATION BOTH ON FRANCHISE AND ON GROSS EARNINGS.

An occupation tax measured by a percentage of the gross earnings of a telephone company, whose franchise is also taxed in connection with its tangible property according to its value as a going concern, does not tax the same property twice.—*Nebraska Telephone Company v. City of Lincoln, Supreme Court of Nebraska, 117 Northwestern, 284.*

ADMISSIBILITY OF TELEPHONIC CONVERSATION IN EVIDENCE.

A telephonic conversation is admissible in evidence, when, from all the circumstances, the identity of the party answering the telephone is established with reasonable certainty; and recognition of the voice, or identity by admission of one who answers that he is the person desired, is not necessarily required.—*Barrett v. Magner, Supreme Court of Minnesota, 117 Northwestern, 245.*

ORDINANCE REQUIRING TROLLEY AND TELEPHONE WIRES TO BE KEPT APART.

The failure of a street railway company and a telephone company to comply with an ordinance prescribing the minimum height and distance from each other than their wires shall be maintained, prima facie shows their negligence, in an action for injury caused by a live wire, resulting from a trolley pole leaving the trolley wire and breaking an overhead telephone wire.—*Southwestern Telegraph & Telephone Company v. Myane, Supreme Court of Akansas, 111 Southwestern, 987.*

PROVISIONS OF TELEPHONE FRANCHISE.

A city telephone franchise providing that the grantee should connect the central exchange, and thereby each subscriber's instrument with other specified towns and cities, and specifying monthly rates of $1.50 and $2.50 for residence and business phones, respectively, does not entile subscribers to service to such other towns and cities without additional charge, but merely gives them the privilege of using long-distance connections from their phones.—*Cumberland Telephone & Telegraph Company v. City of Hickman, Court of Appeals of Kentucky, 111 Southwestern, 311.*

SUIT TO COMPEL EXERCISE OF TELEPHONE FRANCHISE.

Citizens of a city may sue to compel a telephone company to exercise its franchise by operating its plant; the franchise being granted by the city for the citizens' benefit and in consideration of the service to be furnished them, and the remedy at law in behalf of the citizens for the company's breach of contract being inadequate.—*Cumberland Telephone & Telegraph Company v. City of Hickman, Court of Appeals of Kentucky, 111 Southwestern, 311.*

TELEPHONE CALLS—CONSEQUENTIAL DAMAGES.

A telephone company is not liable for consequential damages caused by its negligent failure to notify one for whom a call is placed that another desires to talk to him, unless it knows in some way the nature, purpose, and subject-matter of the proposed conversation, so that the damages likely to result from such failure may be said to have been within the parties' contemplation.—*Southwestern Telegraph & Telephone Company v. Flood, Court of Civil Appeals of Texas, 111 Southwestern, 1064.*

MEASURE OF DAMAGES FOR TELEPHONE COMPANY'S FAILURE TO NOTIFY OF CALL.

Plaintiff's measure of damages against a telephone company for its failure to notify him of a call for him whereby he lost a sale of mules was the difference in their market value when he should have been notified of the call and when he could have sold them by using ordinary diligence, and not the difference between the price for which he could have sold them to the proposed purchaser and the price at which, by exercising reasonable diligence, he thereafter sold them, including necessary expenses for the delay.—*Southwestern Telegraph & Telephone Company v. Flood, Court of Civil Appeals of Texas, 111 Southwestern, 1064.*

Telephonic Reminiscences

By C. E. McCluer

[Sixth installment.]

THEN I decided to apply for a patent on my artificial ground device I was unfortunate in the selection of a patent attorney. Thinking, however, that the man of my choice was unusually competent and efficient, and overburdened as I was by my official duties, I surrendered the management of the case entirely to him, after a lengthy interview during which I endeavored to enlighten him thoroughly as to the philosophy of the invention. For a period of a year or more I answered his communications and the questions and suggestions of the patent office examiner, and signed paper after paper without careful examination. But I finally awoke to the fact that evidently owing to a lack of business tact, and I suspect an entirely inadequate and imperfect conception of the device, the attorney had managed to get the case into a woefully tangled condition. The examiner to whom my application was naturally assigned, the attorney claimed, was a confirmed dyspeptic and a chronic crank who took offense at some of his arguments and had tried to get even with him by throwing in the way of the application all the obstacles he possibly could. When I began to look into the merits and condition of the case I found the examiner had cut the specifications and claims to shreds, and the attorney under the authority conferred by my approval without proper consideration of his suggestions had so altered and amended them at the behest of the examiner that they scarcely bore even a faint resemblance to the application as originally filed. References had been made to and infringements claimed by the examiner on numerous existing patents on entirely dissimilar and irrelevant inventions with which my sluggish lay mind could discover no earthly connection, and my claims and specifications had been so emasculated and narrowed down that it took some study to convince me that the papers I was examining were at all related to my telephone improvement. For a time I wondered if in some mysterious way my application had got "crossed" with some other fellow's application for an improvement in submarine torpedo boats, and I almost imagined I could smell the salt sea air and taste salt water.

While I was thus anxiously endeavoring to locate my application and discover some way to straighten out the tangle, which I did not even then realize in all its full significance, General Barney, the secretary of the Bell Telephone Association, then in the heyday of its existence, hearing in some way of the successful application of my protective device to a portion of the Richmond exchange, and knowing that the rapidly extending and fatally effective interferences of strong current leakage with the use of the telephones had the telephone managers and investors on the tender hooks of anxiety as to the future of their properties, asked me if I would not prepare and read a paper on the subject at the approaching annual convention in the city of New York. I asked the advice of my attorney and he optimistically but mistakenly claimed that the proposed publicity of my invention could not at that stage adversely affect my application, but would more likely hasten the issue of the patent and render it more easy for me to secure the wholesale introduction of the device and begin at once to gather in the royalties thereon. So I cheerfully but foolishly acceded to General Barney's request and attended the New York convention highly elated, and with my paper in my pocket.

Some intimation of my device had evidently gotten to the ears of the American Bell officials, who were out in strong force at the convention and on the *qui vive* for information regarding it. My paper was accordingly listened to with respectful attention, and evidently created a profound impression on the numerous electrical fledgelings who were there in the Bell livery. When I took my seat after having supplemented the paper with a brief statement of the improvement that had been wrought in the night service of the northwestern section of the Richmond exchange where the service of eighty-seven stations had been saved from utter annihilation, a profound silence reigned for several minutes, the collegiate experts being seemingly dumbfounded at the temerity of a provincial like myself coming up there to enlighten them upon such a phase of the telephone business, all expert knowledge of which they had even at that early period in the life of the Bell company begun to arrogate to themselves. The floodgates of sophomoric oratory were opened and I was in a few minutes fairly deluged and completely submerged by the torrent of criticism and vituperation that assailed my ears. I was plainly and emphatically informed that I didn't know what I was talking about, that my theory was contrary to all the well known laws of the universe, and that in the opinion of the speakers my device was perfectly impracticable, and the results that I claimed to have secured, utterly impossible. One young sprig of an electrician even went so far as to assert most positively that he knew it was impossible for my statements to be true, as identically the same idea had occurred to him, and he had tried it, and—it was an utter failure. Another cruel critic ponderously asserted that if my scheme did work as I contended, it was nothing new and I deserved no credit for it because telegraphers had long used a single wire as a common return for their local batteries. I was ridiculed, vilified, abused and classed with those famous or infamous children of Beelzebub, Ananias and Saphira; charged with being visionary and lacking in common sense; advised to cultivate the grace of modesty and retire to the shades of obscurity from which I had emerged.

A condensed and incorrect report of my paper and the subsequent discussion was published in the leading electrical journals and furnished further mental pabulum for our dyspeptic patent examiner which he was unable to properly digest and assimilate, and he made it the text of further criticism of my patent claims, and sheared off a few more features that left nothing but the skeleton, and that not even "wired." For did not one Bell electrician assert that he had tried the same device long before I filed my application for a patent, and did not another one assert that the telegraph people had used the same idea from time immemorial, long before the invention even of the telephone! Then it was that I discovered that my application was in a bad way. I accordingly discharged my attorney from the further prosecution of the case, and the examiner resigning his position in the patent office and hanging out his shingle as a patent attorney about the same time, I secured an interview with him in Washington and in fifteen minutes taught him more

about my device than he had ever learned from my patent attorney during the months of spicy correspondence. He then averred that I was justly entitled to a patent, and declared positively that had he understood the device as an examiner as he now did as an attorney he would have allowed me the patent offhand without any serious objections or any alterations whatever in the specifications and claims. Now that he understood and appreciated the novelty and value of the invention he felt sure he could induce his successor to grant me the patent in short order, with my original claims re-established and reincorporated therein. I paid his fees and within a few weeks, to my intense joy and gratification, I was formally and officially notified that my patent had been allowed and would be issued on payment of the final fee. And it was. But evidently the new examiner was neither so complaisant nor so industrious as my new attorney thought he was, and the correspondence being so voluminous and so involved and intricate it defied even the proverbial Philadelphia lawyer to disentangle the mess, the new examiner cut the Gordian knot by issuing the patent just at the stage in which it was inherited by him. I have the patent now as dry and void of vitality as an Egyptian mummy.

Had I have tendered my device to the Bell people they would doubtless have been glad to pay the patent fees and reward me handsomely ($250 was the usual reward accorded to their employes who were ingenious enough to invent anything, and complaisant enough to turn the device over to them) and then would have calmly buried the patent in oblivion lest some enterprising lessee might attempt to make use of the device. I was always more successful in looking out for the interests of my employers than I was in looking after my own interests, and I was so unsophisticated and outspoken that it was a long time before I recognized the truthfulness of the aphorism that "silence is golden." Hence I frankly and foolishly let it be known at the New York convention that I had already applied for a patent on my common return device. That was like shaking a red flag in the eyes of an already enraged bull. The idea of an employe of the great monopoly daring to apply for a patent when there was a standing offer of the magnificent sum of $250 for all telephonic improvements that were worthy of a patent and which should be assigned to the American Bell Telephone Company. And that too on a device that would have been so valuable in the undisputed possession of the great telephonic corporation! My temerity was never forgotten or forgiven.

The public announcement and discussion of my invention at the New York convention gave it wide publicity, and before I was awarded a patent it had been pirated by nearly every telephone company in the country. That was of course before the expiration of the Bell patent and the advent of the Independent movement, so that all the operating telephone companies then in existence were Bell lessees. The electric light and street railway fads spread with alarming rapidity and put it up to the telephone people to save their exchanges from utter annihilation, and like the proverbial drowning man catching at a straw, they grasped eagerly at my device, and thereby secured their salvation without so much as saying "by your leave, sir!" So that when my worthless patent did issue it had been infringed by every American Bell lessee in the country, and when I timidly suggested the payment of a small royalty for the use of the device a multitude of telephonic thumbs sought the nasal appendages of their owners, while the accompanying digits wriggled gracefully and amiably in the air before them. Subsequent events suggested the idea that word had gone forth from Boston that my demands should be treated with contemptuous silence and my claims ignored entirely. As I possessed no means to begin a fight in the courts and could find no one sufficiently philanthropic to embark in patent litigation with the wealthy and powerful Bell interests, I had to bow meekly to the awards of fate and see my roseate dreams of unbounded wealth slowly but surely fade into thin air. Instead of reaping a fortune for myself as I think would have been justly right and proper, I merely helped to further the fortunes of the Bell cohorts and bring upon my devoted head the full weight of the burning displeasure of the parent telephone company. I do not know certainly what might have been the outcome of my common return venture had I not ill advisedly made it public at the New York convention, but I date the beginning of my ill success with it from that occasion.

It has ever been the settled policy of the American Bell company to exploit its telephone enterprises with other people's money as far as was practicable. Hence instead of investing unlimited capital in the construction and inauguration of exchange systems throughout the country, it contented itself with the immediately exclusive ownership and control of but one exchange plant, that of its home city, Boston. All other cities and all other territory was farmed out under patentee licenses to individuals or subsidiary corporations. Under the terms and conditions of these licenses it was stipulated that all central office and station appliances should be purchased from the official manufacturing concerns, owned and controlled by the lessor, presumably at an enormous profit, and that the absolutely essential patented devices, the receivers and transmitters should be nonsalable, and obtainable only under special contrast and at stipulated annual rentals. The shrewd and astute Bell telephone managers certainly laid their foundations broad and deep, and erected thereon a superstructure designed to last not only during the life of their patents, but during all time.

The lessees, whether individual or corporate, were required to invest their own capital in the construction and equipment of their exchange plants, and were then taxed $25 or $30 per annum for each and every set of instruments they required. As the cost of manufacture of those instruments did not amount to one-fifth of the annual rentals exacted, the parent concern made a big profit on its moderate investment in the apparatus, while the poor lessees had to invest much larger sums, assume far greater risks, and content themselves with smaller profits. With an eye single to future corporate prosperity the Bell managers did not exact any cash payments from their licensees as is customary for territorial patent privileges, but contented themselves with the exaction of a pretty sizeable chunk of their offspring's stock and bonds, to be delivered as soon as the telephonic infant was formally christened and launched into active existence, with further assignments of stocks and bonds to be made as the business was developed, until eventually the parent corporation would hold a controlling interest in its offspring. Hence the immediate interests of the American Bell company and the private stockholders of the sub-companies were not identical.

As long as the controlling interest was vested in the people who put up their good money for the construction of the exchange plants they very naturally desired to derive the largest possible rate of interest on their investments without regard to the coming period when the control would revert to the Bell company. They therefore greatly preferred to have the earnings of their systems distributed to the stockholders in the shape of dividends, rather than see them expended on betterments or immediately non-paying improvements and extensions. Whereas the Bell people who were already in the receipt of handsome returns on their investments in apparatus were comparatively indifferent to the insignificant dividends that would accrue to them on the stock they then owned, but were desirous that the incoming revenues should be exclusively used for immediate improvements and extensions, or future revenue producing increases in capacity and efficiency, so their larger and more satisfactory gains would come later when they came into

larger or complete possession, and that without any material increase in their own investments.

It was on account of this state of affairs, this lack of unity of financial interests as between lessee and lessor that the inventor and his device fell between the upper and nether millstones and were figuratively ground to dust. The municipal electric lighting systems, both arc and incandescent, were extending and multiplying with astonishing rapidity, and the service of every telephone exchange in towns and cities where such systems had been or were being introduced was being driven to the "demnition bow-wows," and threatened with extinction, while the owners were almost distracted by the imminent if not certain ruin of their business, and the total loss of their investments. Then the electric railway calamity loomed on the telephonic horizon and the coming of serious disaster to telephone interests was doubly assured. The youthful college bred electricians of the American Bell company, doubtless incited thereto by older and wiser heads, soon began to demonstrate with mathematical precision that the infusion of "metallic circuits" was the only sensible and efficatious remedy for the inductive and leakage ills to which the supersensitive telephones were heir. The American Bell officials therefore began to talk metallic circuits to the officers and stockholders of the subcompanies, vehemently urging their immediate adoption as the only way by which their investments could be saved. And for a time it did look like there was no other alternative. But the lessees began to count the costs of such a radical change in their plants and systems, and soon found that obedience to the mandate of the Bostonians meant the sacrifice of their present central office and station appliances and the substitution of new appliances suitable for the metallic circuits, as well as the duplication of every subscribers' wire, which in most cases meant the necessity for greatly enlarged pole room, or many miles of expensive metallic circuit twisted pair cables. That also involved the sacrifice to the Juggernaut of the junk pile of all "straight away" wire cable then in use. This looked to them like the doubling of their investments without any corresponding increase in their earnings and they very naturally hesitated just as the Southern Bell officials did under the same circumstances. The "long distance" branch of the American Bell company being compelled to adopt metallic circuits in order to eliminate the interferences due to earth and atmospheric electrical perturbations, had also found that metallic circuit exchange systems would be a *sine qua non* for the physical and commercial success of its ventures, and was insistent on the adoption of the two wire system for local service for the benefit of these enterprises. Just at this juncture of affairs my common return device was publicly announced, and I was soon deluged with inquiries as to sizes of copper wire most suitable for special conditions, best location on poles and fixtures, and sundry other particulars that were rather hazy to the lay telephone mind. These inquiries I answered as best I could, with the idea that I was rendering valuable service to telephone interests generally for which I would be well requited later. Although I hurried the issue of my patent as much as possible, before it materialized nearly every telephone company in the country had adopted the device and every exchange annoyed by strong current leakage had been equipped with it. Quite naturally I was elated. Visions of unbounded wealth danced before my mind and I "laid the flattering unction to my soul" that my days of hard work were at an end, and during the rest of my mundane existence I would be able to "eat, sleep and be merry" without a care for the morrow.

But as the Scottish bard puts it. "The best laid plans of mice and men aft gang aglee." Mine certainly did. I soon learned that the astute Bell attorneys having pronounced my patent "no good," the American Bell magnates had advised their lessees to refuse my demands, doubtless offering to stand between them and any claim for an accounting that I might be disposed to legally institute. I then submitted my patent to a reputable and prominent patent attorney of the national capitol for his unbiassed opinion, which when received knocked the bottom out of my aspirations for immense wealth, and a seventy-five dollar fee out of my pocket book. He agreed exactly with the Bell attorneys that my patent would not stand the superlative test of the federal courts. Thus were not only my exaggerated expectations of immense wealth, and even my modest hopes of a moderate competency cruelly dashed, but the invention and its attempted personal exploitation brought me discredit and persecution from the very people whose interests I thought I was conserving.

The Bell people could find no just cause of complaint against the electric lighting companies on account of the interference by stray currents from their mains with the service of the telephone exchanges, not then having acquired the nerve to dare to abrogate to themselves the exclusive right to the use of the public highways for their lines of poles, or the circumambient atmosphere for their wires. But when the electric street railways began to multiply and extend and get in their work of destroying telephone service, matters became more serious and they decided something had to be done. Failing signally in their efforts to induce their lessee companies to adopt the two wire metallic circuits instead of the McCluer common return, the American Bell folks tried to entrench themselves against the railway interferences by claiming a monopoly of the earth as a common return, on the ground of prior occupation and tried to force the railway corporations to adopt the two wire metallic circuits for their systems and leave them in undisturbed possession of the bosom of old mother earth. To this end they sued out several injunctions against the encroaching railways and endeavored to estop them from the use of their uninsulated rails as one side of their power circuits. The Hon. John S. Wise, a prominent attorney of Richmond, was employed by the Union Passenger railway people to defend them from the attacks of the telephone forces, and he met with so much success and wielded my device of the common return wire so vigorously that the telephone people lost every case. Wise told me subsequently that my device, backed up by an affidavit as to its efficiency which I was innocently and mistakenly induced to give him, was largely if not solely instrumental in enabling him to beat off successfully the telephone attacks. When the telephone attorneys claimed the earth and talked metallic circuits for the railways, the sharp railway attorney treated them to a little of their own medicine and advised them to get off the earth by the help of the McCluer common return, if it was found to be too unhealthy for their continued existence.

Hence the Bell telephone Philistines condemned me and my device in no unmeasured terms as responsible in the first place for preventing them from foisting on their innocent lessee companies the only other alternative of ordinary two wire metallic circuits to save them and their exchange service from ruination and destruction; and second, for preventing them from compelling their electric street railway antagonists to adopt the more expensive and less desirable metallic circuits instead of utilizing their rails for their return in order that interference with the telephones might be avoided. The edict therefore went forth that I was at the first favorable opportunity to be driven out of the ranks of the Bell employes and relegated to a life of "elegant leisure." How this was eventually done will appear later. Suffice it to say now that my invention, which saved the operating companies millions of dollars and untold trouble in an emergency which could have been met in no other way, and its attempted personal exploitation, instead of gaining for me credit and reward, subjected me to adverse criticism and abuse from the very people I was trying my best to serve.

THE TRADE PAPER

Abstract of an Interesting Address Recently Given at the New York University School of Commerc and Finance

By Emerson P. Harris

I HOPE you will pardon me for referring briefly to some things which to you practical business men may seem very rudimentary, and also to some points which I touched upon in my last lecture before you. For, so it seems to me, we can more clearly get at the peculiar and specific services which the trade paper performs in work of marketing.

When you start out to market an article you discover that, aside from finding the possible buyers for whom the article is intended, the great work of selling consists in making the article favorably known to the buyer. That is conveying information with the view of creating desire or demand.

TWO KINDS OF INFORMATION TO BUYERS.

Now, I believe, if you recall your own selling work, the story to your public of your product, you will notice that a large part of your description and argument is practically repeated with every customer. Some of your task, however, consists of inquiry as to the special circumstances and needs of the individual customer. How his case differs from others and in setting forth how your product meets or can be made to meet his specific case and so on.

So, if you go over your selling talk you will find it is of two kinds, first that which is practically repeated to every possible customer, can be given in substantially the same form to your whole buying public; and, second, that which relates to the meeting of the peculiar needs and wants of the individual customer. In other words, you have two kinds of information to give; that which can be duplicated, and that which cannot.

This is a very significant division. The description, argument and praise which can be duplicated can and should be conveyed in a way peculiar to itself. Upon the forceful and far-reaching distribution of this uniform story depends the reputation of the product and the consequent demand for it. Under modern conditions of marketing this reputation-making, want-stimulating message simply must be distributed by machinery to insure economical distribution and the maximum output.

CREATING FAVORABLE DISPOSITION TOWARD A PRODUCT.

The uttering of this uniform message as to the general merits of the product, to that product's whole buying public, is advertising. Work with the individual buyer is salesmanship. What preparation of advertising work and what proportion of salesmanship work there is in any specific marketing problem depends upon the product, its public and conditions peculiar thereto. But to do one kind of work with the other kind of machinery is the cause of great waste.

Now, of this advertising work, the most difficult and most expensive is that of winning for an article such favor from the general public or from a limited public as will predispose the greatest number of people to the greatest possible extent to want the article. This favor-wooing, reputation-making work, which should precede the salesman's work, presents perhaps the greatest problem in marketing. It is working with the unseen and the results are hard to measure, but a small part of the results of reputation-making work manifest themselves in the form of inquiries. Where one reader of advertising makes a sign that he is interested by writing to the advertiser, untold hundreds of thousands are caused to think more favorably of the article and are brought that much nearer buying. This preliminary and main part of the advertising work is done by the public press. But to the marketer who, in his advertising, wants to hit the right nail on the head in the right way, the popular newspaper and magazine have two weaknesses. One is that they go to everybody, regardless of whether they are possible buyers of the particular article advertised, thus including large waste circulation to be paid for by the advertiser. The other is that the advertising is not germane to the purpose of the newspaper or magazine, and, therefore, is in a way an intrusion upon the reader.

WHERE ADVERTISING DOES NOT INTRUDE.

Here is where the trade and technical paper comes in to do a work of exceeding value to the advertiser. The trade paper reaches a group of readers who, by subscribing for the paper, prove that they are interested in and are possible buyers of a certain line of commodities. The trade paper addressed, let us say, to the cotton manufacturer, is taken only by the man whose salary or profits depend upon his being posted not only in methods and processes, of cotton manufacture, but also as to appliances, tools and supplies intended to increase output, reduce cost, or in some way contribute to the success of his business.

Now, just what advantages does a textile paper offer the manufacturer of an article intended for a textile mill? Assuming, of course, that the paper is of real value to the reader, it does three things for the advertiser; it sifts out of the business public the people engaged in that line of business, and the ones who are sufficiently progressive and open-minded to read an inquire, and so most likely to take the initiative in buying new things, and it reaches the reader at the moment when he is receptive to new suggestions. These selective services which the trade paper performs are of immense value to the advertiser, and are entirely unique with the trade paper.

A FORCE FOR PROGRESS.

But the trade paper does more, it not only reaches the right man in the right line of business in the right way, but its editorials always urging progress and the best labor saving and cost saving appliances still further stimulate the reader to enterprise and independent action in the introduction of new things.

While these points which make for power in the trade press as a marketing force are as yet far from being fully recognized, the growth of advertising in the specialized journal has been very great during the past few years. And I am confident that, as manufacturers come to fully recognize its real selling force, and make wiser and more intelligent use of it, they will find it a great source of economy in marketing their products.

WIRELESS TELEPHONY

Abstract of a Paper read before the American Institute of Electrical Engineers at Atlantic City

By R. A. Fessenden

[The first installment of this paper appeared in the August TELEPHONY.]

C. Theory of Wireless Telephony.

FOR wireless telephony three things are necessary:

1. Means for radiating a stream of electrical waves sufficiently continuous to transmit the upper harmonics on which the quality of the talking depends.

2. Means for modulating this stream of waves in accordance with the sound waves.

3. A continuously responsive receiver giving indications proportional to the energy received, and capable of responding with sufficient rapidity to the speech harmonics.

Work on the wireless telephone was commenced before a satisfactory means was discovered for producing sustained oscillations.

To ascertain the number of sparks per second which was necessary to determine articulate speech, a phonograph cylinder was taken and grooves were cut in it longitudinally. It was found in this way that practical transmission could be accomplished with 10,000 breaks per second. It is believed now that this number is unnecessarily high, possibly owing to the fact that it was impossible to cut the grooves on the cylinder without producing ridges. The lower limit may be fixed in another way.

Electrical circuits met with in actual working have resistance, self inductance capacity, and leakage. Heaviside gave the differential equations for the pressure and current over such circuits when alternating voltages were applied, but no method of solution being known the mathematical treatment of such circuits was restricted to cases where one of the constants was neglected, until Dr. A. E. Kennelly in a masterly series of papers gave the complete solution.

The results were immediately found applicable to a great variety of problems, such as the transmission of signals through cables and of telephonic speech through various types of circuits.

In this way Dr. Kennelly[1] by comparing the results obtained by Dr. Hammond V. Hayes[2] in practical telephonic transmission over loaded lines with the theoretical values of the current for different harmonics showed that harmonics above 2,000 per second could be neglected for telephonic transmission.

The writer has never succeeded in obtaining good talking with such a low frequency, but under favorable conditions fairly satisfactory speech may be obtained with 5,000 interruptions per second. For really good transmission, however, the radiation must be practically continuous, for if the spark frequency is less than 20,000 per second there is a disagreeable high pitch note in the telephone, not noticeable perhaps at first but apt to become annoying with use. The most satisfactory way is, of course, to use a source of sustained oscillations.

It fortunately happens that for wireless telephonic purposes it is inadvisable to use a wave frequency of less than 25,000 per second on account of the difficulty in radiating energy with low frequencies.

The receiver must, of course, be continuously responsive. If, for example, it had to be tapped back in order to restore it to the responsive condition, speech could not be transmitted.

[1] Kennelly, "Distribution of Pressure and Current Over Alternating Current Circuits," Harvard Engineering Journal, 1906, page 43.
[2] Hayes, "Loaded Telephone Lines in Practice," Transactions International Electrical Congress, St. Louis, Vol. 3.

It must also give indications proportional to the energy received or the character of the speech will be distorted.

It must also respond with sufficient rapidity. If, for example, it takes a thousandth of a second to restore itself to its original resistance the receiver will obviously not record the higher harmonics. I have experimentally determined that a receiver which restores itself in the ten thousandth part of a second acts with sufficient rapidity.

D. History of the Development of Wireless Telephony.

The writer has been asked on several occasions how the wireless telephone came to be invented. In November, 1899, shortly prior to the delivery of my previous paper,[1] while experimenting with the receiver shown in Figure 3

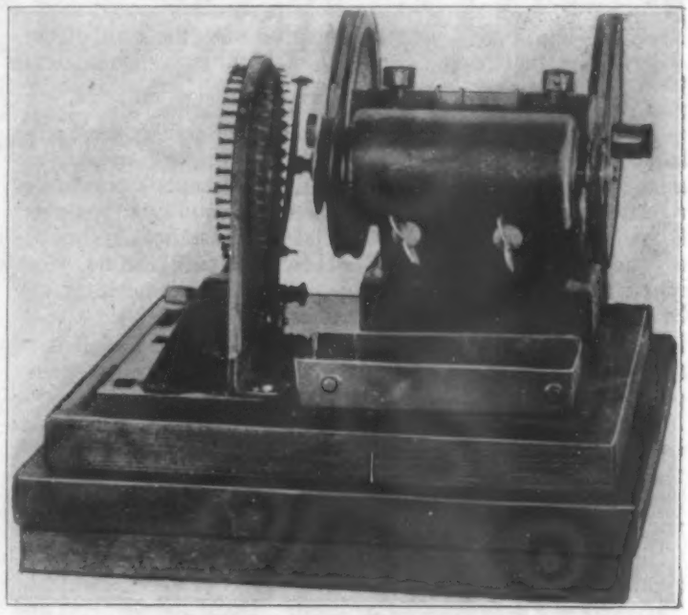


Figure 2.

of that paper, I made some experiments with a Wehnelt interrupter for operating the induction coil used for sending.

In the receiver mentioned the ring of a short-period Elihu Thomson oscillating current galvanometer rests on three supports, *i. e.*, two pivots and a carbon block, and a telephone receiver is in circuit with the carbon block. A storage battery being used in the receiver circuit[2] it was noticed that when the sending key was kept down at the sending station for a long dash the peculiar wailing sound of the Wehnelt interrupter was reproduced with absolute fidelity in the receiving telephone. It at once suggested itself that by using a source with a frequency above audibility wireless telephony could be accomplished.

Professor Kintner, who was at that time assisting me in these experiments and to whose aid their success is very largely due, was kind enough to make the drawings for an interrupter to give 10,000 breaks per second. Mr. Brashear, the celebrated optician kindly consented to make up

[1] Transactions American Institute Electrical Engineers, Nov. 22, 1899.
[2] U. S. patent, 706,736, December 15, 1899.

the apparatus and it was completed in January or February, 1900.

The experimental work was, however, delayed as the writer was at that time transferring his laboratory from Allegheny, Pa., to Rock Point, Md., and it was not until six months later that the stations at that point were completed and a suitable mast was erected for trying the apparatus.

The first experiments were made in the fall of 1900 with the above mentioned apparatus which was supposed to give 10,000 sparks per second but which probably gave less. Transmission over a distance of one mile was attained but the character of the speech was not good and it was accompanied by an extremely loud and disagreeable noise, due to the irregularity of the spark.

By the end of 1903 fairly satisfactory speech had been obtained by the arc method above referred to, but it was still accompanied by a disagreeable hissing noise. In 1904 and 1905 both the arc method and another method in which the 10,000 cycle alternator above referred to was employed, had been developed to such an extent that the apparatus could be used practically and sets were advertised and tendered to the U. S. Government.[1] The transmission was, however, still not absolutely perfect.

By the fall of 1906 the high frequency alternator had been brought to a practical shape and was used for telephoning from Brant Rock to Plymouth, a distance of 11 miles, and to a small fishing schooner,[2] this being the first instance in which wireless telephony was put in practical use. The transmission was perfect and was admitted by telephone experts to be more distinct than that over wire lines, the sound of breathing and the slightest inflections of the voice being reproduced with the utmost fidelity.

As it was realized that the use of the wireless telephone would be seriously curtailed unless it could be operated in conjunction with wire lines, telephone relays were invented both for the receiving and transmitting ends and were found to operate satisfactorily, speech being transmitted over a wire line to the station at Brant Rock, retransmitted there wirelessly by a telephone relay, received wirelessly at Plymouth and there relayed out again on another wire line. On Dec. 11, 1906, invitations were issued to a number of scientific men to witness the operation of the wireless transmission in conjunction with the wire lines.[3] A report of these tests appeared in the American telephone Journal of Jan. 26 and Feb. 2, 1907, the editor being one of the men present.

In July, 1907, the range was considerably extended and speech was successfully transmitted between Brant Rock and Jamaica, Long Island, a distance of nearly 200 miles, in daylight and mostly over land,[1] the mast at Jamaica being approximately 180 feet high.

In 1907 several European experimenters succeeded in transmitting speech wirelessly, using some of the earlier forms of the writer's arc method, and some months ago the vessels of our Pacific squadron were equipped with wireless telephones, using this arc method, by another American company.

E. Methods and Apparatus.

1. *Methods and apparatus for producing the electromagnetic waves.* These have been already referred to. Figure 2 shows a rotating spark-gap giving approximately 20,000 discharges per second. This was connected to a 5,000-volt source of direct current. Terminals are 40 per cent platinum-iridium. In operation the apparatus is arranged to charge a condenser to a definite potential and discharge it.

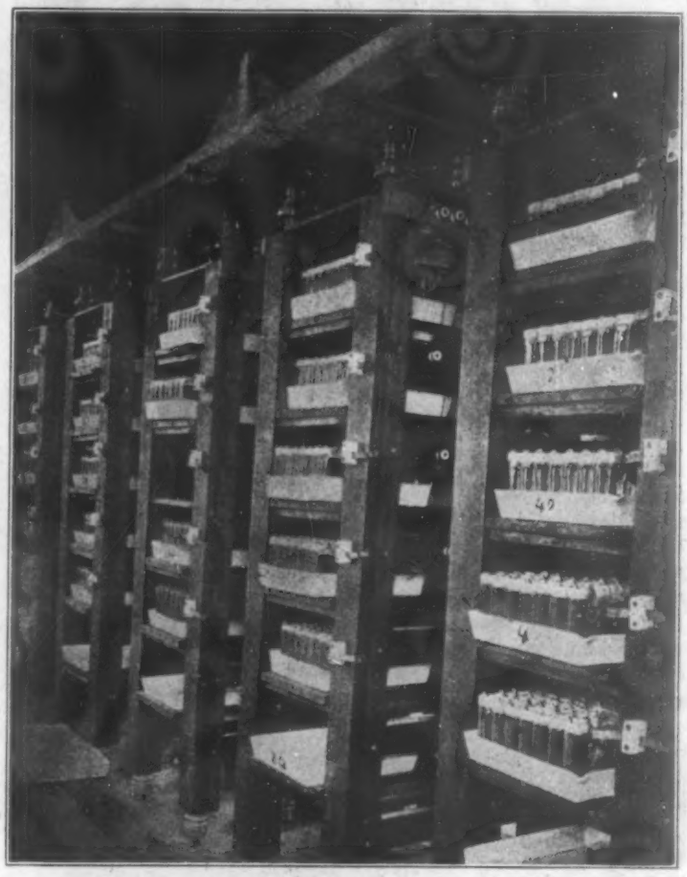


Figure 3.

Figures 3 and 4 show forms of apparatus for operating the arc in a gas under pressure.

The apparatus of Figure 4 is also used for the arc in vacuum and the critical distance arc.

Figure 5 shows a multiple gap with rotating electrodes, brass, amalgamated zinc and graphite being used.

Figure 6 shows a multiple arc gap with electrodes of different materials, the upper terminals being water cooled.

Figure 7 shows a condenser dynamo.

Figure 8 shows a general view of one type of high frequency alternator. It is driven by a motor and a DeLaval gear. It has been operated at 96,000 cycles per second, but is generally run at 81,700.

[1] Letter of July 8, 1905; see The Electrician, London, Feb. 22, 1907; also catalogue of 1904 and subsequent.

[2] An amusing instance may be mentioned as illustrating the incredulity with which the wireless telephone was received. Some of the local papers having published an account of the experiments with the schooner above referred to the following appeared under the heading "Current News and Notes" in the columns of a prominent technical journal, Nov. 10, 1906:

"A New Fish Story.—It is stated from Massachusetts that the wireless telephone has successfully entered into the deep sea fishing industry. For the last week experiments have been conducted by the wireless telegraph station at Brant Rock, which is equipped with a wireless telephone, wtih a small vessel stationed in the fleet of the South Shore fishermen, twelve miles out in Massachusetts Bay. Recently, it is asserted, the fishermen wished to learn the prices ruling in the Boston market. The operator on the wireless fitted boat called up Brant Rock and telephoned the fishermen's request. The land operator asked Boston by wire and the answer was forwarded back to the fishermen. This is a rather fishy fish story."

The doubt expressed was, however, only natural. I remember the astonishment displayed by one of the company's new operators some months previously on placing the receiving telephone to his head while the vessel was almost out of sight of land and hearing the operator at the land station called his name and begin to talk to him.

[3] Brant Rock, Mass., Dec. 11, 1906.

American Telephone Journal, 100 William St., New York City.

Dear Sirs: A limited number of invitations have been issued to witness the operation of the National Electric Signaling Co.'s wireless telephone system between Brant Rock and Plymouth, Mass., over a distance of between ten and eleven miles.

The tests will be as follows:

1. Transmission of ordinary speech, and also transmission of phonographic talking and music by wireless telephone between Brant Rock and Plymouth.

2. Transmission of speech over ordinary wire line to wireless station at Brant Rock, relaying the speech there automatically by telephone relay and automatically transmitting the speech by wireless to Plymouth, transmitting same at Plymouth automatically directly or by telephone relay over regular wire line.

Invitations have been issued to the following gentlemen (here follows list of some of the guests, including Dr. A. E. Kennelly, Professor Elihu Thomson, etc., and a request to the company to send a representative).

Yours very truly,
National Electric Signaling Co.

[1] "Long Distance Wireless Telephony," The Electrician, Oct. 4, 1907.

Figure 9 shows a field disc; it is 12 inches in diameter and there are 300 slots on it.

Figure 10 shows the armature and field coils. There are 600 armature slots each containing two turns of 13 mil wire. The field current is 5 amperes. The resistance of the armature is 6 ohms; it gives 160 volts and about 7 or 8 amperes. Other armatures have been constructed having a resistance of 4 ohms. For some work double armatures are used giving about 270 volts. The output of the single armature machines at 81,700 cycles is approximately one kilo-

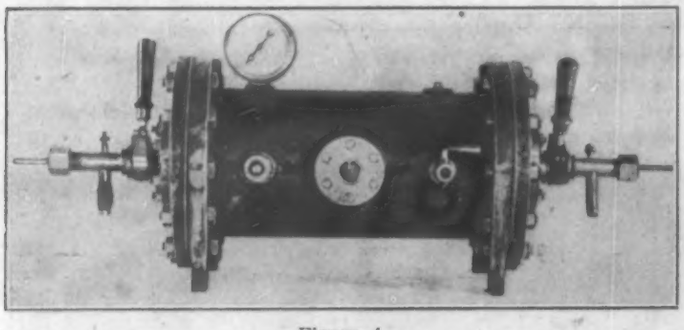


Figure 4.

watt. The output of the double armature machine is approximately 2 kilowatts.

Other types of high frequency alternators are under construction. One type shown in Figure 11 is designed for use on shipboard. The armature disc is 6 inches in diameter and two armatures are used. It is arranged to be mounted on gimbals and to be driven by a steam turbine connected to the steam pipe by flexible armored steam hose. The frequency is about 100,000 and the output about 3 kilowatts.

Another type, which is at present being constructed by Mr. Alexanderson, to whose efforts the success of this type of generator is largely due, is designed to have an output of 10 kilowatts. Designs have been made for a generator of still larger size with a calculated output of 50 kilowatts and a frequency of 50,000. This machine is intended for transatlantic work.

For some of these machines, instead of driving by gear or steam turbine, a special two-cycle motor has been devised, to operate at a frequency of 500 cycles per second.

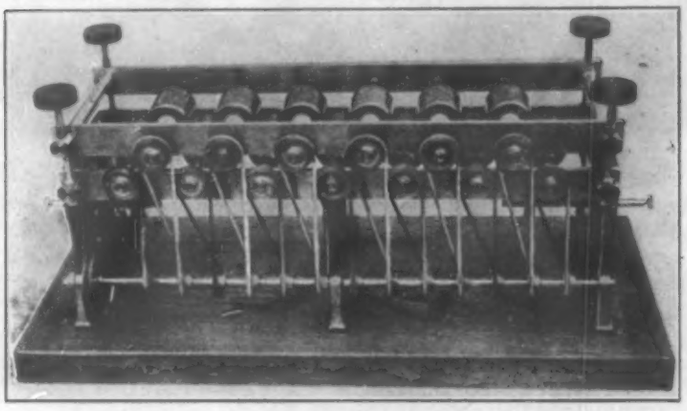


Figure 5.

The high frequency alternator method is believed to possess a number of advantages over other methods, inasmuch as it is set in operation by merely opening a steam valve and has no complicated electrical apparatus or circuits of any kind. The speed is regulated by the steam pressure, this being accomplished by an electrically operated reducing valve.

For measuring the frequency various speed indicators have been tried, but it has been found that the best way is to use a resonant circuit with an ammeter shown in Figure D, in it,[1] this being an extremely sensitive means of indicating the frequency and in addition affording a means of automatically keeping the speed constant to a small fraction of a per cent. The reducing valve is adjusted so that if left to itself the machine will run slightly above speed. As soon as it reaches one-tenth of one percent higher than its designed speed the resonance begins to fall and a contact is opened which slightly throttles the steam. In this way the frequency is kept varying between the limits of one-tenth of one per cent above speed and one-tenth of one per cent below speed. Where the drive is electric instead of by turbine, a storage battery is used to drive the two-phase generator and even better results may be obtained as regards regulation than with steam.

2. *Transmitters.* The types of transmitters most com-

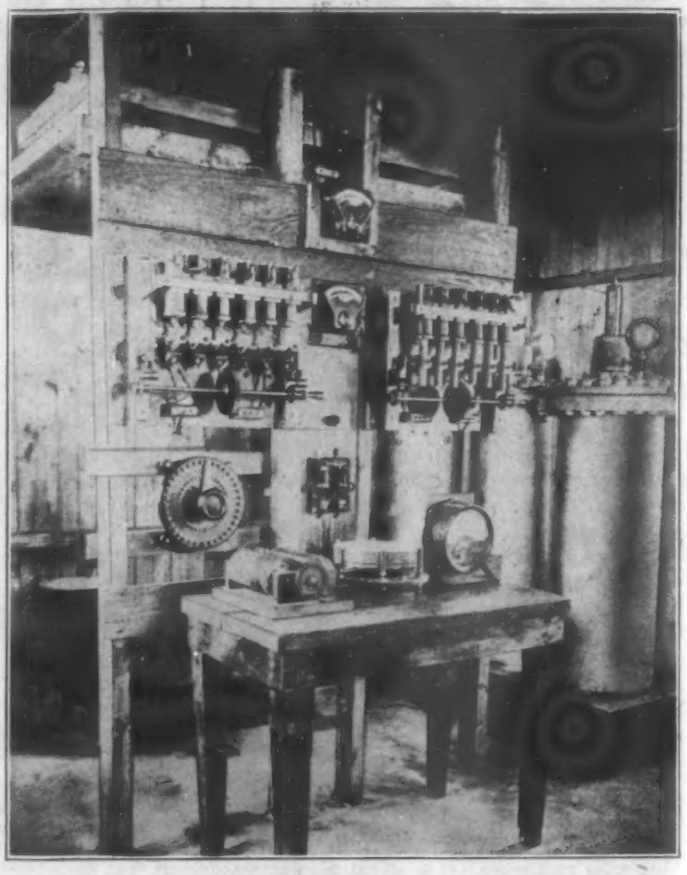


Figure 6.

monly used are the carbon transmitter and static transmitter, and the carbon transmitter relay.

Figure 12 shows the standard type of carbon transmitter.

It was found that the ordinary carbon transmitter was unsuited for wireless telephonic work on account of its inability to handle large amounts of power. A new type of transmitter was therefore designed which the writer has called the "trough" transmitter. It consists of a soapstone annulus to which are clamped two plates with platinum iridium electrodes. Through a hole in the center of one plate passes a rod, attached at one end to a diaphragm and at the other to a platinum iridium spade. The two outside electrodes are water-jacketed.

This transmitter requires no adjusting. All that is necessary is to place a teaspoonful of carbon granules in the central space. It is able to carry as much as 15 amperes continuously without the articulation falling off appreciably. It has the advantage that it never packs. The reason for

[1] Electrical World and Engineer, Nov. 11, 1899.

this appears to be that when the carbon on one side heats and expands the electrode is pushed over against the carbon on the other side. These transmitters have handled amounts of energy up to one-half horse power, and under these circumstances give remarkably clear and perfect articulation and may be left in circuit for hours at a time. Figure 13 shows a modified form with split back.

Figure 14 shows a type of condenser transmitter in which the vibration of the diaphragm alters the electrical capacity of the transmitter, thus throwing the circuit in and out of tune or spilling more or less energy through a leakage. circuit.

Figure 15 shows a transmitting relay for strong currents. The only thing noticeable about this is that the telephone magnet is a differential one.

Figure 16 shows another type of transmitting relay, for amplifying very feeble currents. It will readily be understood that where a person in Albany, 10r example, wishes to talk to another person on board a ship off New York, the wireless station being located near New York, the volume of the transmission received at New York will not be very strong, and while it may be possible to transmit it without amplification, amplification is advisable.

This receiver is a combination of the differential magnetic relay and the trough transmitter. An amplification of fifteen times can be obtained without loss of distinctness. The side electrodes of the trough are water-jacketed. The successful amplification depends upon the use of strong forces and upon keeping the moment of inertia of the moving parts as small as possible. Amplification may also be obtained by mechanical means but as a rule this method introduces scratching noises which are very objectionable even though comparatively faint.

Other types of transmitters have also been used, such as liquid jet transmitters, Figure 17 transmitters operating by closing the air-gap in a magnetic circuit, and so changing the inductance of the oscillating circuit, etc.

Figure E shows a loud-speaking telephone receiver. A small iron disk is placed opposite a nozzle through which air at high pressure is blown. As is well known, this

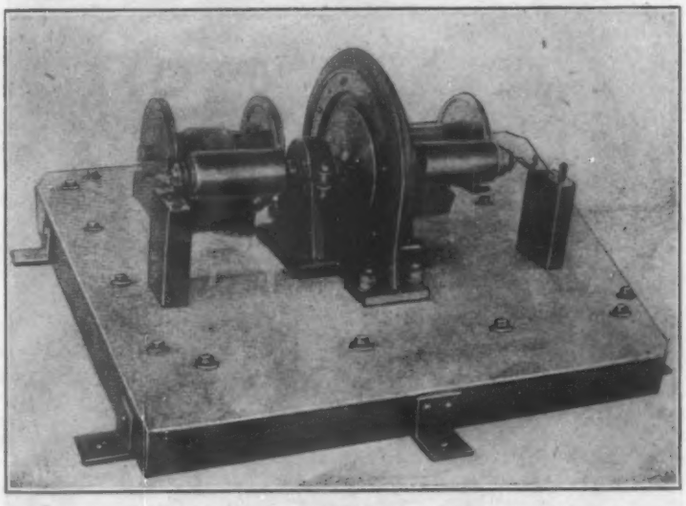


Figure 7.

causes the disk to be held close to the nozzle. The telephone magnets alter the position of the disk and thus produce very loud talking.

The transmitting relays are connected in the wire line circuit in the same way as the regular telephone relay, except that in place of being inserted in the middle of the line they are placed in the wireless station and an artificial line is used for balancing. There is no difficulty met with on the wireless side of the apparatus, but on the wire line side there are the well-known difficulties due to unbalancing which have not yet been entirely overcome. For the correction of these difficulties, therefore, we must look to the engineers of the wire telephone companies. At present the difficulties are if anything less than those met with in relaying on wire lines alone.

3. *Transmitting circuits.* Figure 18[1] shows a type of arc circuit.

Figure 19[2] shows a suitable type of connection for use with a high frequency alternator.

Figure 20[3] shows a type of circuit for use with the condenser transmitter.

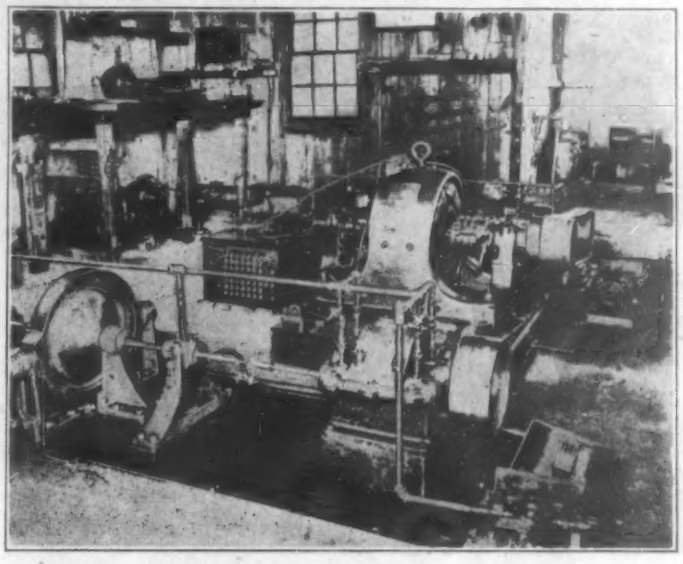


Figure 8.

Figure 21[4] shows a type of circuit in which the modulation is accomplished by changing the inductance of one of the oscillating circuits.

As a matter of fact the transmitter may be placed almost anywhere in the circuit between the arc or dynamo and the antenna, or between the arc or dynamo and ground, or in the transformer circuit, or in the shunt to an inductance or capacity, the results obtained in all cases being indistinguishable. The sole criterion of success seems to be that the transmitter should be capable of handling the energy and the circuit should be properly adjusted. Some success has also been attained by placing the transmitter in the field of the dynamo[5] but this method requires very careful designing of the field circuit.

4. *Receivers.* The receiver which the writer has found most satisfactory for general purposes is the liquid barretter. Figures 22 and 23 show this receiver. It consists of a fine platinum wire, about a ten thousandth of an inch in diameter immersed in nitric acid. Tests made with this receiver show that it responds without apparent loss of efficiency to notes as high as 5,000 per second. Some very careful measurements recently made by my assistants, Messrs. Glaubitz and Stein, give the following results:

Voltage of high frequency circuit necessary to produce readable signals,	15×10^{-5} volts.
Ohmic resistance of receiver,	2,500 ohms.
Value of high frequency current necessary to produce readable signals.	6×10^{-5} amperes.
Electromagnetic wave energy required to produce audible note for period of one second.	1×10^{-4} ergs.

The telephone used for detecting the signals had a resistance of approximately 1,000 ohms. Some measurements

[1] U. S. patents Nos. 706,742, June 6, 1902, and 730,753, April 9, 1903.
[2] U. S. patent No. 706,742, June 6, 1902.
[3] U. S. patent No. 706,747, Sept. 28, 1901.
[4] U. S. patent No. 706,747, Sept. 28, 1901.
[5] U. S. patent No. 793,649, March 30, 1905.

were made to determine the change of current in the telephone circuit by using a sensitive galvanometer in series with the telephone but the results obtained were obviously too low, possibly on account of the electrostatic capacity of the turns of the galvanometer with respect to each other. It will be noted that the amount of electromagnetic wave energy necessary to produce a signal is considerably less than that given in a previous note.[1] The difference is possibly to be attributed to improvements in adjustment and operation.

The above measurements were taken by shunting the barretter across a piece of straight resistance wire in series

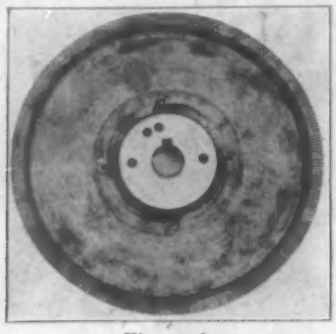


Figure 9.

with a hot-wire ammeter, to determine the voltage necessary, and by introducing resistance in series with the barretter to determine the resistance of the barretter. The figures were also checked in a number of other ways and very concordant results were obtained, so that it is believed they may be relied upon.

The previously mentioned thermoelectric receivers or rectifiers of Dr. Austin and Mr. Pickard shown in Figures 24 and 25 and the vacuum tube receivers of Fleming, de Forest, and Cooper Hewitt also act very satisfactorily. The fact that the writer has not been able to get as good results from them may be due to greater familiarity with the liquid barretter and heterodyne receiver.

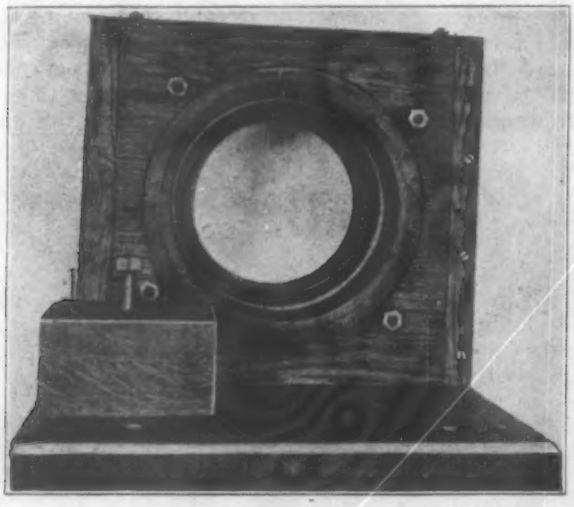


Figure C.

Figures 26, 27, and 28 show a form of heterodyne receiver adapted for use for telephonic work.

5. *Receiver connections.* Where the wireless telephone is operated by first talking into the transmitter and then throwing a switch and listening, the usual wireless telegraphic connections are used. This has been found in practice to be very inconvenient, however, and several methods have therefore been devised for talking and listening simultaneously, which methods can, of course, also be applied to duplex wireless telegraphy. Among these methods may be mentioned the commutator method[1] and the balance method.[2]

The former method is fairly well known and consists in rapidly connecting alternately the transmitter and receiver. The balance method consists in using a phantom aerial as

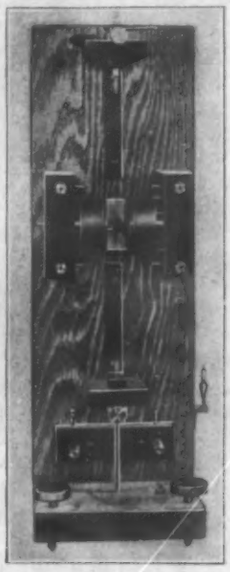


Figure D.

shown in Figure 29, where *P* is a phantom aerial, the circuit having such capacity inductance and resistance as to balance the radiating antenna. The apparatus is shown in Figure H.

In order entirely to cut out disturbances in the receiver

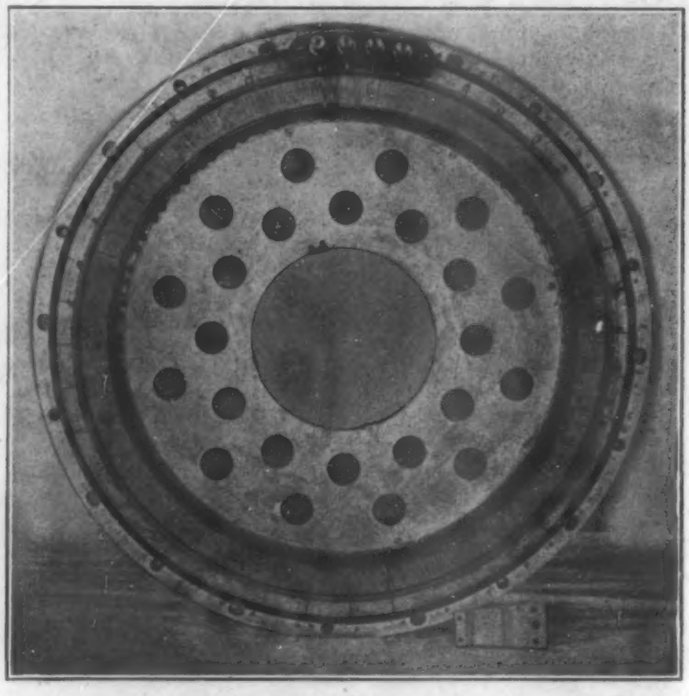


Figure 10.

while sending, an interference preventer, *I. P.*, the elements of which are shown in Figures I and J, is used in the receiving circuit.

It may be here mentioned that balance methods work much better with wireless telephony and telegraphy than

[1] Electrical World and Engineer, Oct. 31, 1905.

[1] U. S. application, 350,199, Dec. 31, 1906.
[2] U. S. application, 366,528, April 5, 1907.

with line telephony and telegraphy, for the reason that the radiation resistance of an antenna is absolutely definite and is not affected by the weather, as are line circuits. Consequently, the balance can be made very sharp and once made does not need to be altered.[1] Of course, half the energy is lost but this is a matter of practically no importance, as the cutting down of the strength of a telephonic conversation to

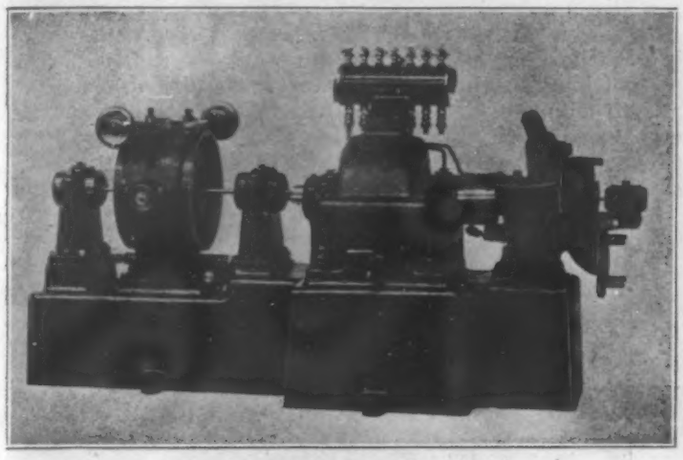


Figure 11.

one-half is as a rule hardly noticeable, especially where there are no line noises or distortion of the speech through capacity effects.

6. *Receiving station relay.* The receiving station relay is similar to the transmitting relay shown in Figure 16. The

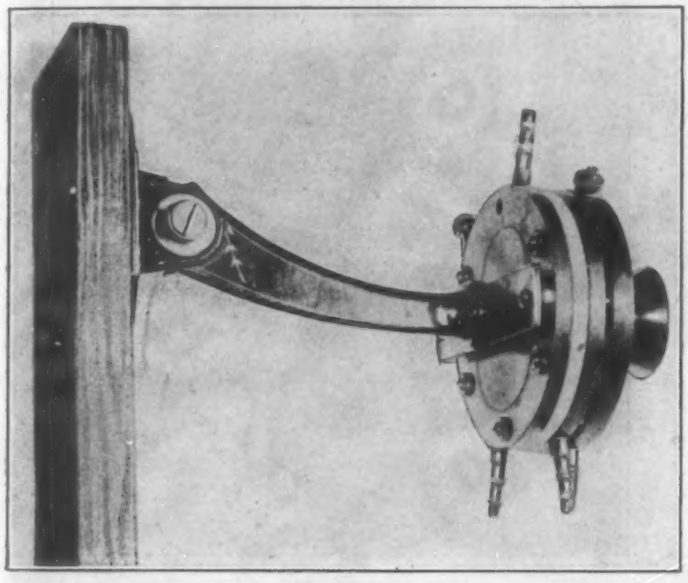


Figure 12.

same remarks apply to its use in connection with wire lines as to the transmitting relay.

F. OPERATION.

As will be realized from the above, the operation of a wireless telephone system is very simple. The operator merely throws his switch to the position for telephoning and talks into an ordinary transmitter and listens in an ordinary telephone receiver. When the duplex method is

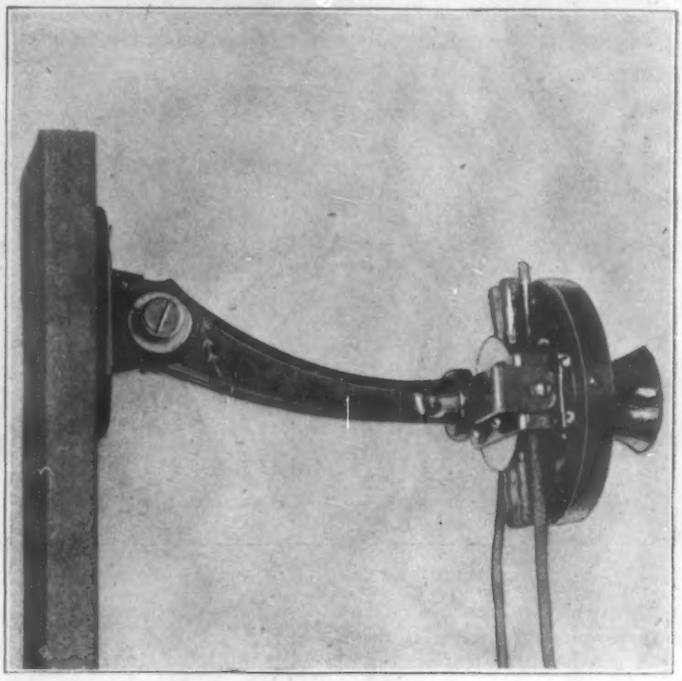


Figure 13.

used, as is always advisable, the conversation proceeds exactly as over an ordinary telephone line. Figure F shows a phonograph transmitting music and speech wirelessly. Figure G shows talking by relays from a local circuit.

I believe I am correct in saying that the transmission by wireless telephone is considerably more distinct than by wire line and that the fine inflections of the voice are brought out much better. This, I presume, is due to the fact that there

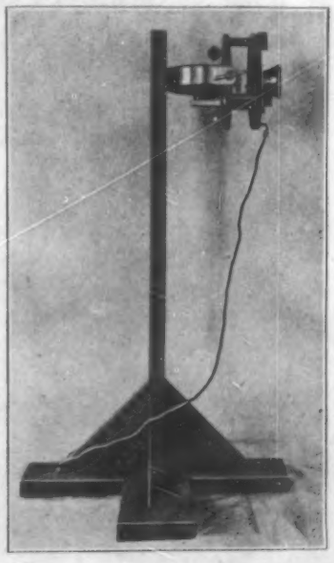


Figure 14.

is no electrostatic capacity to distort the speech, as in the case of wire lines, though I think the effect is also partly due to the absence of telephone induction coils with iron cores. Possibly some of the readers of this paper witnessed the operation of the wireless telephone transmission between Brant Rock and Plymouth and between Brant Rock and Brooklyn. If so I think they will bear me out in saying that the transmission was clearer than over wire lines.

[1] This method may, of course, be used for duplex working in wireless telegraphy. As some question has been raised in regard to the capacity of wireless telegraph lines the writer would say that he has received messages at the rate of 250 words per minute by wireless and is now experimenting with apparatus designed to give 500 words per minute. With duplexing this gives 1,000 words per minute or 60,000 words per hour. The manager of one of the largest cable companies has stated (London Daily Mail, Sept. 24, 1907) that all the Trans-Atlantic cables together send 24,000 words per hour. It would appear, therefore, that if capacity alone be considered a single station on each side of the Atlantic can handle more traffic than all the present cables. It should be pointed out, however, that the mere ability to handle the messages is not sufficient and that unless the wireless telegraph companies obtain land facilities equal to those at present enjoyed by the cable companies they cannot handle the traffic as efficiently, i. e., cannot deliver a message from New York to an individual in London and receive a reply in the same time. Fig. K shows a Wheatstone transmitter used for the test referred to.

As a rule, there is absolute silence in the wireless telephone receiver except when talking is going on, though of course the usual noises may be heard if persons are walking across the room, etc. This makes listening in less of a strain than when talking over wire line. Even during severe atmospheric disturbances the talking is not interfered

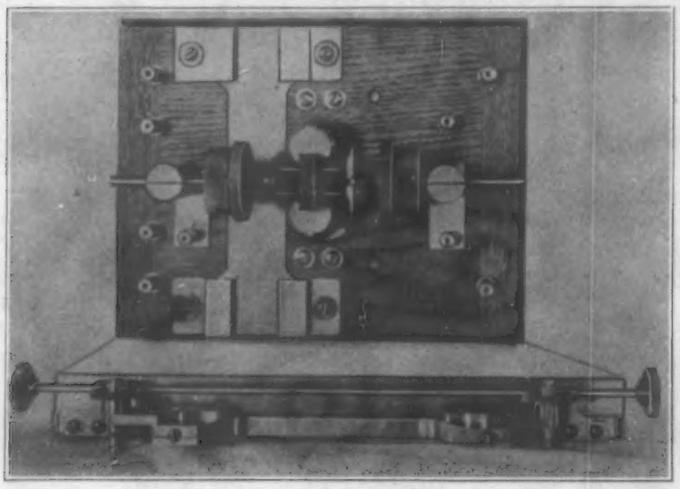


Figure 15.

with to any noticeable extent, provided of course that an interference preventer is used.

A comparative test was made with talking between Brant Rock and Brooklyn by wireless and by wire telephony. The talking over the wire line was done from a long distance station in Brooklyn. The wireless transmission was considerably the better. The fact that the wire line included in its circuits a cable from New York to Brooklyn was of course a disadvantage, but even allowing for this, practice and theory appear to be in agreement to the effect that transmission by wireless telephony over long distances is better than by wire line.

This method should be of especial value to Independent telephone companies, which have their local exchanges, but

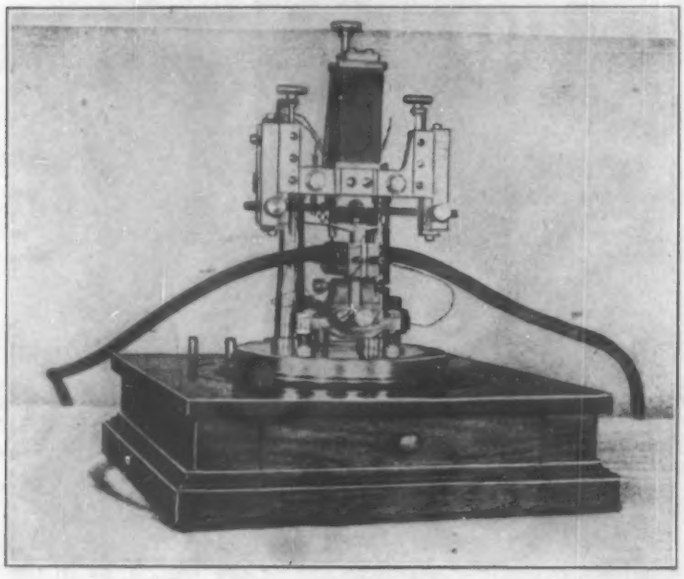


Figure 16.

no long distance lines, especially since no franchises or rights of way are necessary.

G. POSSIBILITIES.

A. *Local exchanges.* There is no immediate prospect that wireless telephony will take the place of local exchanges. The difficulty in regard to the number of tunes can be overcome, but the fact remains that high frequency oscillations cannot be transmitted over wire and hence each subscriber must have his own generating station. At the present time no method is known which would be practical if placed in the hands of a subscriber. If such means should be found it would be very convenient to call up directly instead of through an exchange, but as I see it there are no immediate prospects of this.

B. *Long distance lines.* I believe, however, that there is a field for wireless telephony for long distance lines. The present long distance lines are very expensive to construct and to maintain, and a storm extending over any considerable section of country inflicts considerable loss on the telephone companies. Moreover, the distance of transmission is limited by the electrostatic capacity of the line, as I

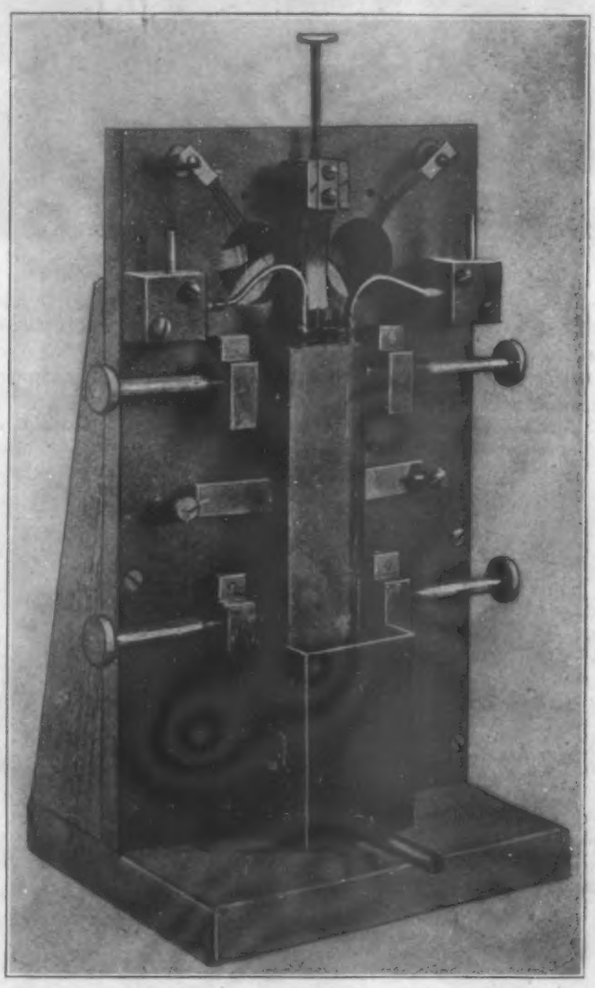


Figure 17.

understand it. Wireless telephony would have the following advantages:

1. The initial cost would be very much less than that of wire lines.
2. The maintenance would be practically negligible in comparison.
3. In case of any breakdown, it would be right in the station and not at some unknown point outside on the line.
4. The depreciation would be comparatively small.
5. The number of employes required would be smaller.
6. The transmission is better, and as there is no distortion of the speech, the working distance is, it is believed, considerably greater.
7. The flexibility is greater. With wire lines a telephone company may not be able to give a Boston subscriber a line to New York, while having lines from Boston to Chicago

and from Chicago to New York free. Operating wirelessly the wireless circuit normally used for operating between

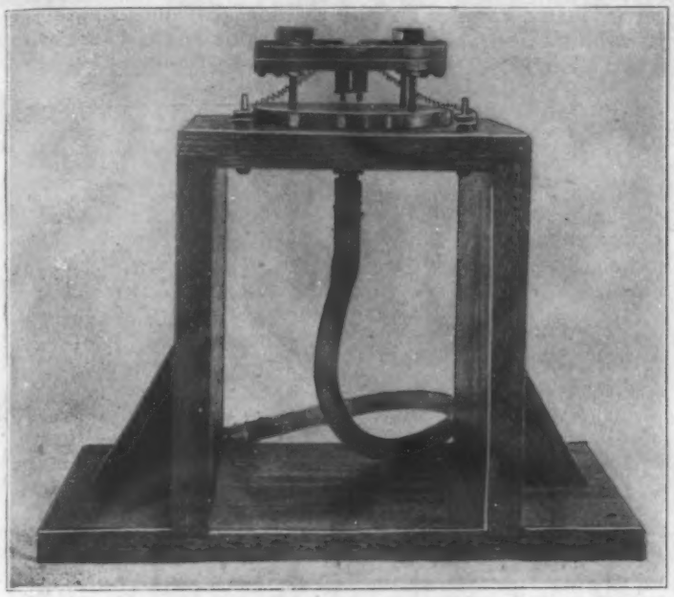


Figure E.

New York and Chicago and between Boston and Chicago could be used to operate from Boston to New York.

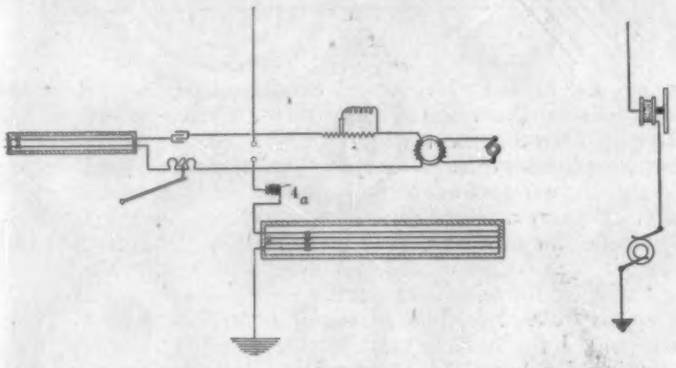


Figure 18.

Figure 19.

8. No right of way need be purchased and franchises it is believed, are not necessary.

It will be noted that I have carefully avoided mentioning

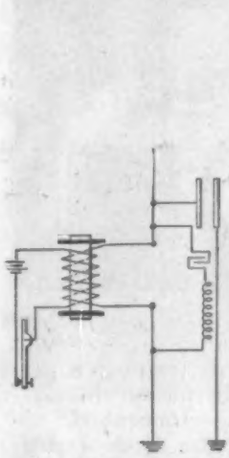


Figure 20.

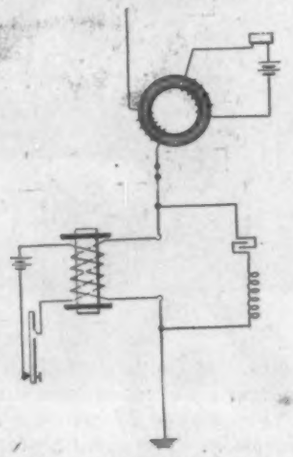


Figure 21.

any of the disadvantages of wireless telephony for long distance work. I presume this is because I am not a telephone engineer. I hope the defects will be supplied by the experts who are familiar with telephone operation and therefore better able to point out the defects. Before leaving this part

Figure 22.

of the subject I would say that I think the question of interference has been worked out to such an extent that no serious difficulty need be feared in that direction.

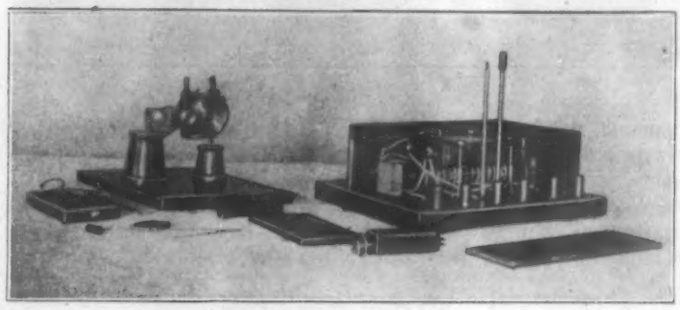


Figure 23.

C. *Transmarine Transmission.* Wireless telephony is peculiarly suited for this class of work. Pupin's ingenious and beautiful method has been successful at Lake Constance,

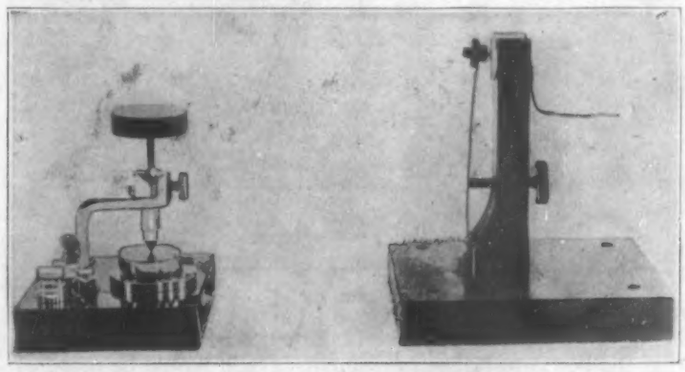


Figure 25.

Figure 24.

Switzerland, I believe, but even assuming that deep-sea cables of this type could be laid and operated successfully, they would nevertheless be very much more expensive than wireless telephone stations. It is believed that wireless

telephony will come into extended use for this purpose. Even without further development telephonic communication could be established between Norway or Denmark or Germany or Spain and Great Britain; between Sardinia and Corsica and France and Italy; between France and

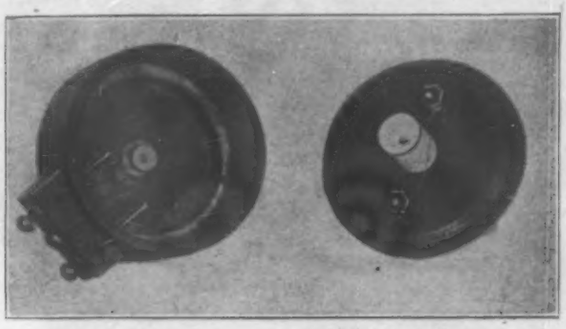


Figure 26.

Algeria, between Australia and Tasmania and New Zealand; between the United States and Cuba and Porto Rico, etc., were it not that it is at present forbidden by law.

As regards telephonic communication between England and America, my measurements show that this should be

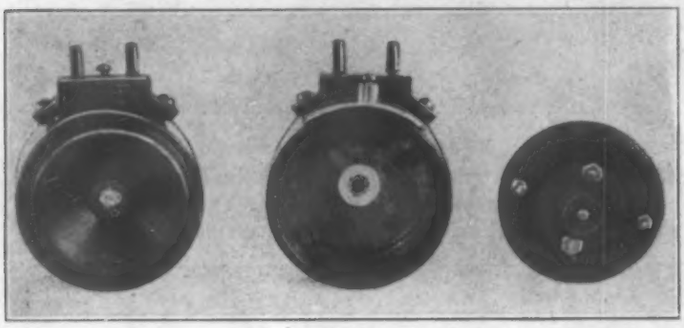


Figure 27.

possible with an expenditure of approximately ten kilowatts and suitably large towers say 600 feet high, or with some of the new forms of antenna. Whether such a transmission would be commercially valuable or not is another matter. Personally I do not see that it would, but when I remember that at the time when the telephone was first

Figure 28.

being introduced a number of eminent business men decided that the house-to-house printing telegraph would be more of a success commercially than the telephone for the reason that no one would want to do business unless he were able to have a record of the transaction, I must admit that there is a possibility of my being mistaken in this.

D. *Wireless telephony from ship to ship.* Here, of course, wireless telephony occupies a unique position. Wireless telegraphy has the disadvantage that a telegraph operator must be carried. The additional expense is an objection in many cases. The proposition that the captain or mate should also be a telegraph operator has not met with favor. Anybody, however, can operate the wireless tele-

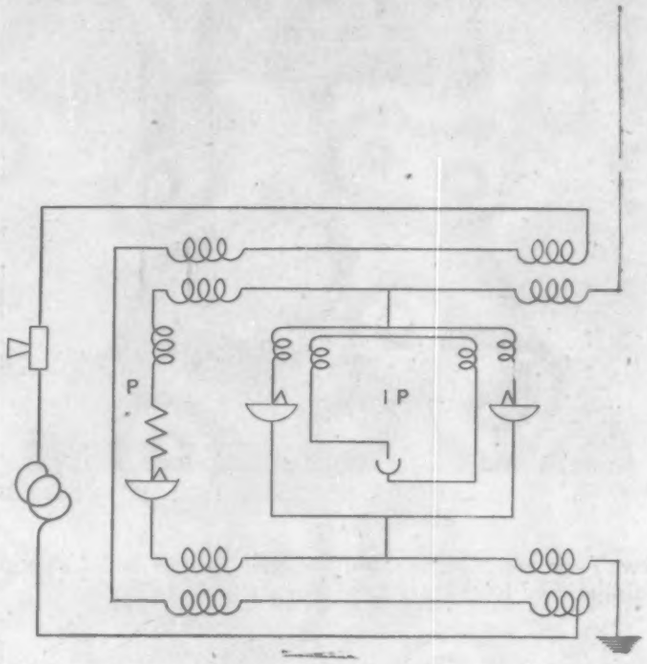


Figure 29.

phone and almost every vessel carries an engineer capable of repairing the electrical apparatus in case of accident. The final arrangement will, I believe (if we can prevent the governments from carrying out their proposed laws, forbidding wireless telephony), be this; that passenger vessels will carry a telegraph operator and use the telephoning apparatus for ordinary work and for telegraphing where it is desired to communicate over long distances. Other vessels will use the telephone alone.

E. *Wireless telephone from ship to local exchange.* This also will, I think, have considerable value, as enabling the captain of a vessel to communicate, by relaying over the

Figure F.

wire line, with the owner of the ship, or enabling a passenger on a vessel to communicate with friends on shore.

F. *Range of wireless telephony.* 1. *Atmospheric absorption.* The great obstacle to long distance wireless telegraphy and telephony is atmospheric absorption. For short distances up to 100 miles in the temperate zone there is little difference between the strength of the signals at one time of the day and another. As soon as the distance is in-

creased much over 100 miles for the temperate zones and 40 or 50 miles for the tropics the signals at night are very irregular and there is great absorption during the day time. The daylight absorption may be so great that less than a

Figure G.

tenth of one per cent of the energy transmitted gets through. Some nights will be as bad as daytime while on other nights there will be apparently no absorption.

Figure 30 is a curve showing the strength of the messages

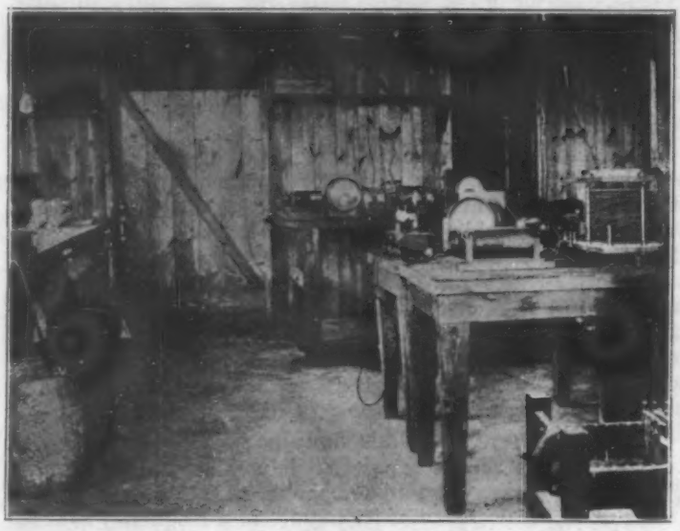


Figure H.

transmitted between Brant Rock, Massachusetts, and Machrihanish, Scotland, at night, during January, 1906. Nothing at all was received that month during daytime.

The change in the strength of the signals is very sudden.

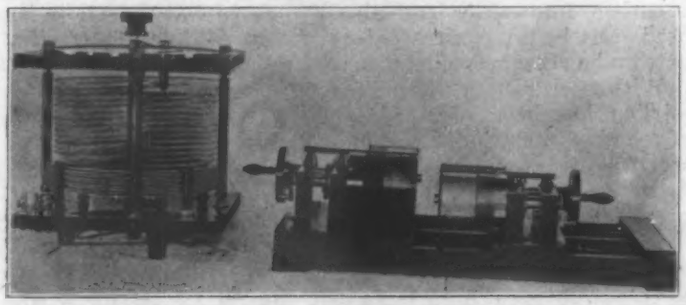


Figure I.

In working from Brant Rock to Porto Rico, a distance of 1,700 miles, the strength of the signals with short wave lengths would fall off to one one-thousandth of their former value during a period of less than fifteen minutes, while the sun was rising.

Early experiments showed that the absorption was greater as the wave length was increased and the effect was at first attributed to absorption in the neighborhood of the sending station, and was thought to increase continuously with the wave length. This fluctuating absorption at one time ap-

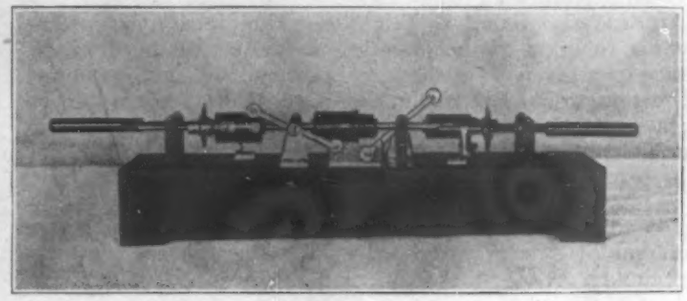


Figure J.

peared to place a fundamental obstacle to commercial wireless telegraphy, as telegraph engineers will easily appreciate the impossibility of operating telegraph systems with cir-

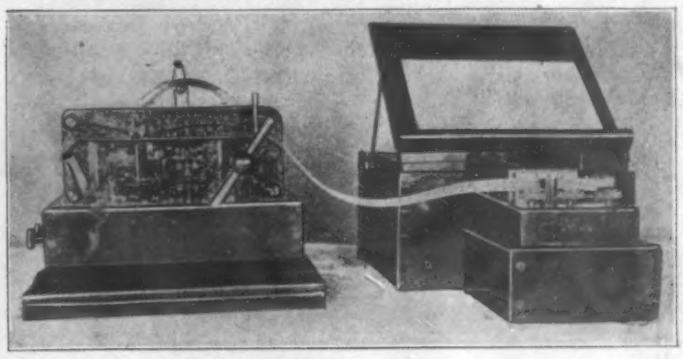


Figure K.

cuits where the strength of the received signals may fall to one-thousandth of its value or rise to a thousand times its value in the course of a few minutes.

It was therefore considered absolutely essential, in order to decide whether long distance wireless telegraphy was commercially possible or not, to investigate this phenomenon

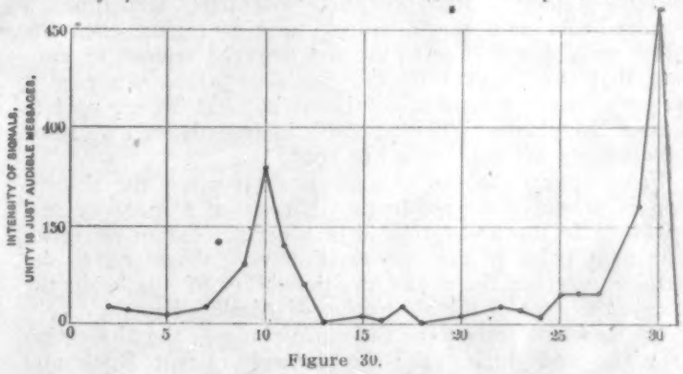


Figure 30.

fully. As a preliminary the station at Brant Rock sent to four or five other stations at varying distances and comparative readings were taken. The following table shows the general character of the results obtained:

Station.	Distance	Strength of signals received on worst nights (strength of unabsorbed signals being taken as 1,000).
Company's cottage	200 yards	1,000
Lynn	30 yards	1,000
Schenectady	170 miles	500
Philadelphia	270 miles	300
Washington	400 miles	150
Machrihanish	3,000 miles	1

These experiments proved conclusively that the absorption did not take place in the neighborhood of the sending station, because the strength of the signals received at nearby stations was the same during the day as during the night while there was great variation in the strength of signals received at stations further away.

It was also found that the absorption at a given instant was a function of the direction as well as of the distance, since on a given night the signals received by stations in one direction would be greatly weakened, while there would be less weakening of the signals received by stations lying in another direction, while a few hours or a few minutes later the reverse would be the case.

This was thought to be connected with the coming weather conditions but before this fact is proved a much larger amount of data must be collected. Through the kindness of the U. S. Weather Bureau I was enabled to obtain a chart of the magnetic variations and on comparison of these with the absorption between the Massachusetts and Scotland stations there appeared to be a quite definite relation, *i. e.*, the greater the absorption the greater the magnetic variation. Here also, however, much more data is needed before arriving at a definite conclusion. The fact that the absorption did not take place in the neighborhood of the sending station having thus been definitely settled the next point to be investigated was whether or not there was any way of overcoming it.

The fact that variations in the absorption occurred with

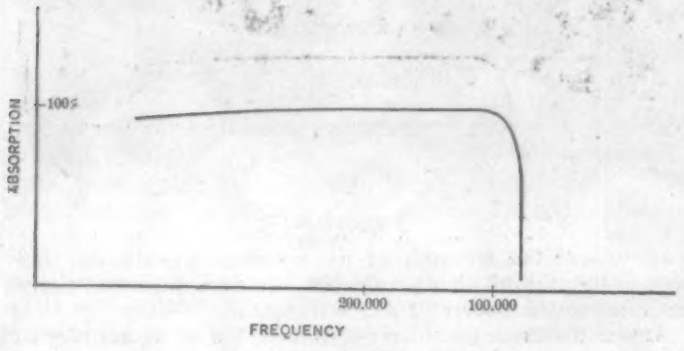


Figure 31.

extreme rapidity, the absorption increasing sometimes a hundred-fold in a single minute, and at night, when the effect could not be due to the sun directly, seemed to indicate that the body producing the absorption, whatever it was, was not in a state of continuity but was broken up into masses like clouds.[1] This also was in accordance with some experiments made in Brazil in 1905.

From optical theories it is known that where the absorption is produced by conducting masses of a more or less definite size the absorption is to a certain extent selective. The next point in the investigation was, therefore, to determine whether there was any possibility of this being the fact in the case of the absorption of wireless signals.

Comparative tests were therefore made of the absorption at night and during the day between Brant Rock and Washington, with wave lengths varying from a fraction of a mile up to four or five miles. It was found that the absorption did not increase continuously with the wave length but reached a maximum and then fell off with great suddenness.

Figure 31 shows the general character of the curve, the ordinates referring to the amount of the absorption and the abscissas to the wave of frequency.

It may be noted that the absorption is a maximum at a frequency of about 200,000 per second, nine hundred and ninety-nine thousandths (0.999) of the energy being absorbed at this frequency during daylight, while for a frequency of 50,000 the absorption does not appear to be appreciable. Longer experiments, of course, might show some absorption, but in any case it is of a different order from the absorption for the shorter wave lengths.

Experiments were then made between Brant Rock and the West Indies, a distance of 1,700 miles, during the spring and summer of 1907. It was found that the results were of the same character, *i. e.*, that while there was greater absorption for frequencies of 200,000 there was comparatively little absorption for frequencies in the neighborhood of 80,000 and messages were successfully transmitted in daylight with this latter frequency. No messages were received in daylight with the higher frequency, though messages transmitted from the same station and with the same power and frequency were officially reported as having been received at Alexandria, Egypt, a distance of approximately 4,000 miles.

The fact that these experiments were made during summer weather, and the receiving station was in the tropics, and the fact that the distance, 1,700 miles, was practically the same as that between Ireland and Newfoundland definitely settled the question as to whether long distance wireless telegraphy was a commercial possibility or not and the results were therefore published.[1]

Since the publication of the above results transmission has been accomplished by means of these long waves over still greater distances during daylight. Sig. Marconi early in October, 1907, succeeded in operating between Glace Bay, Nova Scotia, and Clifden, Ireland, a distance of more than 2,000 miles, at a frequency of approximately 70,000. The same messages were received at Brant Rock, Massachusetts, a distance of nearly 3,000 miles.

Still more recently Captain Hogg of the "Glacier" has written that during the southward passage of the Pacific fleet he received messages from the station at Brant Rock, Massachusetts, while off Cape Ste. Roque, Brazil, S. A. The frequency used for sending was approximately 80,000, and the messages were received with the very interesting and sensitive silicon receiver invented by Mr. Pickard. This distance of 3,000 miles is the greatest yet achieved by wireless transmission during daylight and would indicate that with the use of suitably high towers much longer distances can be reached.

2. *Range of wireless telephony and wireless telegraphy compared.* For the same power it is possible to telegraph to a further distance than to telephone. Distinct speech depends upon the presence of harmonics of a frequency as high as 1,200 per second. The amplitude of these harmonics is according to some rough experiments made by the writer only about one per cent of the fundamental frequency. Consequently, with a perfectly modulated transmitter 100 times as much energy would be necessary to telephone a given distance as to telegraph. It fortunately happens, however, that a carbon transmitter and also the circuits in which it is used, can be so constructed as not to modulate perfectly but can be arranged so as to accent the higher harmonics.

With transmitters arranged for the purpose good transmission has been obtained with thirty times the energy required to produce audible telegraphic signals. By still further modification the power required has been reduced to approximately ten times that necessary for telegraphing, curiously enough without noticeably distorting the character of the speech. There is one fact, however, which prevents the ratio from being as large practically as the instruments show, *i. e.*, speech can be satisfactorily understood with a less increase of power above a minimum audibility than telegraphic signals.

The amount of power necessary for wireless telephony may therefore be taken as approximately five to fifteen times that necessary for wireless telegraphy; *i. e.*, under the same

[1] Electrical Review, May 18, 1906.

[1] The Electrician (London), July 26, 1907.

circumstances and for the same power the wireless telegraph will carry two to four times as far. The difference in range would be very much greater also but for the curious fact that there is much less falling off with sustained oscillations than with intermittent groups of waves, even though the frequencies are identical.

This fact has been repeatedly determined by sending between Brant Rock and Brooklyn on the same frequency, using in the one case spark produced trains of waves and in the other the high frequency dynamo. The difference in the falling off for the same frequency and energy is very great but further work is necessary before anything very definite can be said about it or the reasons finally determined.

H. HOW WIRELESS TELEGRAPHY HAS BEEN THROTTLED BY GOVERNMENTAL ACTION.

The question has been asked why, if wireless telegraphy can compete with wire lines and cables, it is not put into operation. This is not an unnatural question. Ninety-nine individuals out of a hundred would probably consider that if an inventor had perfected a system of wireless telegraphy or telephony so that it would operate reliably over long distances and would handle messages at a fraction of the cost of the present cables and without interfering with other stations, he would immediately pick out from an atlas half a dozen suitable points for operation, such as from France to Algiers, Italy to Egypt, Great Britain to Germany, New Zealand to Australia, Australia to Hong Kong, or Canada to Great Britain, and immediately commence commercial work, being perhaps delayed a few weeks on account of some slight formalities in connection with obtaining permits. The statement that nothing of the sort could be done would be received with incredulity, especially if it were known that the business men who would benefit by the proposed transmissions were strongly desirous of having them put into operation.

This is a very important matter, not because the crushing out of a new system of telegraphy is so very important in itself, but because the prospects are that other branches of the electrical profession may have to face the same situation in the near future, and it is, therefore, advisable to show in some detail just what governmental ownership means in its relation to the progress of civilization. I will, therefore, explain fully, but as briefly as possible how commercial wireless telegraphy is hindered by governmental action.

Examination of a chart of the world immediately suggests a number of points as suitable for the installation of wireless communication. For example the following:

1. United States to Cuba.
2. United States to Porto Rico.
3. United States to Jamaica and other West Indian islands.
4. United States to Bermuda.
5. United States to Newfoundland.
6. United States to Great Britain.
7. United States to France.
8. United States to Azores.
9. Newfoundland to Great Britain.
10. Great Britain to Ireland.
11. Great Britain to France.
12. Great Britain to Spain.
13. Great Britain to Germany.
14. Great Britain to Denmark.
15. Great Britain to Norway.
16. France to Algiers.
17. Italy to Egypt.
18. New Zealand to Australia.
19. Australia to Hong Kong.

The first fact to be noted is that these countries with the exception of Porto Rico are foreign countries and that in practically every one of these, Porto Rico is believed to be the only exception, there are stringent laws in force forbidding the erection of wireless stations without permits. The difficulty of obtaining these permits is shown by the fact that one wireless company within the writer's knowledge has been endeavoring for more than four years to obtain permits in the majority of the above mentioned foreign countries and has so far succeeded in obtaining only one permit and that for direct communication between the United States and Great Britain.

To take a specific illustration. In 1903 an American company was requested to install communication between Bermuda and the United States. The principal industry of Bermuda is the growing of produce of various kinds, which is exported almost entirely to the United States. The only present means of communicating is through Nova Scotia, and in winter especially, owing to the delays on the land lines, the service is often quite insufficient. Permission was asked of the home government by the Bermudian incorporators, but without success.

A petition was then signed by virtually every prominent business man in the islands and forwarded to the home government. The members of the New York Produce Exchange drew up a petition and forwarded it to the Secretary of State requesting him to use his influence in the matter. The Colonial Office stated in reply that it was favorable to the project but that the matter must be referred to other branches.

The Bermudian business men also sent several representatives to Great Britain to urge personally the granting of the permit. After a lapse of several years a definite reply was received to the effect that the permit would not be granted. The Bermudians then took up the matter through a Canadian company which sent several representatives to interview the authorities in Great Britain but without success. The Lord High Commissioner of Canada, Lord Strathcona, finally was kind enough to interest himself in the matter and personally presented the case before the British authorities. It is hoped by the Canadian company and the Bermudians that the permit will finally be granted, but this specific illustration will explain the difficulty in obtaining permits for operation.

As illustrating a different obstacle the case of Newfoundland may be taken. This is the natural point for establishing communication with Great Britain and the experiments previously referred to as having been made between Massachusetts and the West Indies showed conclusively that there would be absolutely no difficulty in operating commercially and with ease over this distance. On the other hand to operate directly from America is a much more difficult proposition for the reason that, as examination of a great circle chart will show, the whole of Newfoundland and Nova Scotia lies between any point in the United States north of Hatteras, and Great Britain.

If operation in Newfoundland were not forbidden by law half a dozen wireless stations would be at once erected, and the companies would be only too glad to pay into the Newfoundland treasury the ten or twenty thousand dollars per annum to be collected if they were put on the same footing as the cable companies in order to save the cost of the longer transmission. The Newfoundland government a number of years ago granted a monopoly of wireless telegraphy to one company, which company has never erected a transatlantic station in that island. While this monopoly has been very injurious to Newfoundland, on account of the loss of revenue entailed, it has been still more so to the wireless companies and to the public at large, which otherwise would have had cheap transatlantic telegraphy several years ago.

Another very formidable obstacle is the fact that in practically all the foreign countries referred to (and in Porto Rico) land telegraphy is a government monopoly. Consequently, the wireless companies are entirely at the mercy of the government, are barred from collecting their own messages and must pay whatever tolls are fixed by the various governments. This, of course, also operates to prevent rapid service, since instead of communicating directly from Paris to London the messages would have to be sent from

Paris by wire line to the French wireless station, thence to the English wireless station and thence again by wire to London.

In a number of countries, the cable lines are also owned by their governments which makes them naturally averse to losing the invested capital or to permitting private companies to compete. It would be evident therefore that no matter to what perfection the art of wireless telegraphy is brought, years will elapse and the exercise of a great deal of political influence will be necessary before the public gets the advantages of the cheaper rates.

Ship communication. Here again the development of wireless working has been stifled by legislation. Vessel owners were at first rather slow to take up the matter of equipping their ships but after the system had proved its worth in several cases and some of the owners had had to pay large sums for salvage in cases where a wireless installation would have avoided the loss, its value began to be realized. It was at this point that the governments again stepped in with premature and injurious legislation. As a specific illustration, a United States company had arranged with the owners of some two hundred vessels to construct a line of stations from Maine to Texas, to operate with stations installed on the ships. The announcement was made that the administration proposed to recommend to Congress that wireless telegraphy be made a government monopoly.

A representative of the wireless company requested permission to submit some evidence to the effect that such a government monopoly was not necessary and that the various stations could operate without interference. A reply was received from the administration that "information in regard to the subject was not desired," and the administration recommended that wireless communication with ships should be made a government monopoly.[1]

It was proposed to carry this out as follows:

1. To establish navy wireless stations at points along the coast where wireless stations were needed by the merchant marine.[2] [3]

2. To forbid the operation of private stations at these points.[4]

3. The navy stations are to handle all messages to and from ships free of charge.

4. Wireless companies to be permitted, after obtaining a license from the Department of Commerce and Labor, to erect stations at points where there was no merchant marine business.[5]

The official approval and transmission of these recommendations by the administration, although they were opposed and never went into effect, terminated, of course, all negotiations with vessel owners, since the owners would naturally not agree to contract for the transmission of their messages with the immediate prospect in view that the government would transmit them free of charge. At the present time the masts ordered for the proposed line of stations are rotting at various points along the seaboard and the apparatus purchased for installation is deteriorating in storage.

The development of ship communication had just begun to recover from this blow when an International Wireless Telegraph Conference was arranged for by the various governments. In America no opportunity was afforded the wireless companies of presenting the case to the delegates to the conference, and a very stringent set of regulations was adopted. The administration transmitted these regulations to the Senate.[1] The ratification of the treaty embodying these regulations was opposed by the Marconi Company, and by the National Electric Signaling Company. The following facts were pointed out:

1. That the proposed regulations virtually amounted to confiscation of the property of the wireless companies; that the working at present was carried on at a loss; that no wireless company was at the present time paying dividends; that the proposed rates would not permit of any return on the capital invested; and that the regulations would so limit the amount of business which it would be possible to transact that it would not pay to keep up the stations.

2. That the inventors in the art of wireless telegraphy had expended large sums of money in developing their systems, and such confiscation was therefore unjust and was thought to be unconstitutional.

3. That the regulations were impracticable in the following respects:

a. By requiring ships to use two tunes only[2] all stations were placed, so to speak, on two-party lines, thereby producing a maximum of interference and preventing any one station working while any other was operating.

b. Allowing only five minutes per message and assuming only ten ships each with ten messages to be in the neighborhood of a given seaport, more than eight hours would have to elapse before the last station had transmitted its message. This time is believed to be underestimated, as the regulations provide that each ship before sending its message must call the coastwise station, have a number assigned to it, inform the coast station of its distance, its true bearing in degrees, its true course in degrees, its speed in nautical miles, the number of words it has to transmit; must be informed how long it will have to wait, whether the transmission is to be in alternate order or in series, interrupt the sending after each 20 words, send an interrogation mark, wait for repetition of the last word, etc.[3] Hence it would be rather difficult to maintain the average time mentioned. This excessive delay would cut down the traffic to such an extent as to render it impossible for the stations to pay expenses of maintenance, and any telegraphic engineer will appreciate the difficulty of carrying on commercial business under such regulations.

c. Placing all vessels on two-party lines introduces all the difficulties of the party line method and loses the only advantage, as it might easily happen that a ship in distress using one frequency might be within range of a number of vessels using the other frequency, but outside of range of any vessel using its own frequency. The obvious and practical method is legally to establish a single tune to be used exclusively for calling and distress signals but not for any other purpose; the transmission of messages to be continued by switching over to other tunes once the call has been received and accepted. In this way a ship in distress can always be sure of calling any vessel within range, while the transmission of messages can be carried on without interference and without one ship having to wait until the other is finished.

4. Its restrictions are of such a character as to prevent the development of wireless telegraphy. For example:

a. The regulation[4] that all stations must carry a licensed

[1] Recommendations of the Inter-departmental Board on Wireless Telegraph, 1904, submitted and approved by the Administration.

[2] Ibid. "That the maintenance of a complete coastwise system of wireless telegraphy by the Navy Department is necessary for an efficient and economical management of the fleets of the United States in time of peace and their efficient maneuvering in time of war."

[3] Ibid. "As fast as the naval wireless telegraph stations are in operation the Navy Department shall receive and transmit through these stations free of charge all wireless messages to and from ships, providing such stations do not come in competition with commercial stations, until such time as Congress may enact the necessary legislation governing this subject." That the statement in regard to competition is disingenuous will be seen from examining the following extra Note 4, since only one station, and that a navy one, would be permitted at points where there was merchant marine business.

[4] Ibid. "In asking for legislation on this point the board invites attention to the fact that where wireless stations are needed for the merchant marine, as a rule, the navy will also require them. The board believes it to be in the interest not only of government but of public economy and efficiency to permit the naval stations to handle the public service, for in the present state of the art but one station is desirable for the public interest in such places. It is admitted that there may be special cases where private stations can serve a useful purpose and the board believes that the Department of Commerce and Labor should have the duty of issuing licenses in such cases under such regulations as will prevent interference with stations necessary to the national defense."

[5] Ibid.

[1] Senate Document, Sixtieth Congress, first session.

[2] Regulations II and III.

[3] Regulations 19 to 26.

[4] Section 6, paragraph III.

wireless telegraph operator capable of receiving at twenty words per minute would prevent the installation of wireless stations on board the majority of ships since only the larger vessels can afford the additional expense of the operator. Many vessels would install wireless telephones which do not require a skilled telegraph operator, if it were not for this regulation.

b. The rules forbidding[1] the transmission of telegrams calling for repetition of messages, or for acknowledgment of receipt, or for telegrams to be forwarded, or for telegrams to be delivered by express or by mail, or for the transmission of money-order telegrams or for the transmission of telegrams with answer prepaid, or for the transmission of urgent telegrams are especially restrictive. By forbidding the transmission of telegrams of all the above classes the commercial field of wireless telegraphy is limited to such an extent as to deprive wireless telegraphy of its chief value.

5. It expressly forbids the use of a number of the most important developments in wireless telegraphy. For example:

a. Section 3 in effect forbids long distance transmission in daylight. This section states that ships must not use wave lengths exceeding 600 meters. It is now well known that daylight absorption is very great for these wave lengths and that much longer wave lengths must be used during daytime. This rule therefore virtually forbids wireless telegraphy during daylight except within a very limited radius, and in case of an explosion or fire on shipboard during daylight the vessel would be unable to summon assistance unless by some fortunate chance another vessel happened to be within the radius limited by the restriction to the short wave length. It also virtually prohibits ships keeping in communication with the shore for more than twelve hours out of twenty-four.

b. Section 3 states that the system employed must be a syntonized system, thus forbidding the use of systems such as the heterodyne sytem which do not depend for selectivity on syntony. This would not be so injurious if it were not for the fact that the present indications are that syntony will in the near future be abandoned as a means of obtaining selectivity.

c. The rules of Section 2, 3, and 18 to 26, virtually forbid the use of duplex and multiplex systems. There is no reason why a number of ships should not communicate with the same station simultaneously, but the above rules forbid this by requiring only two wave lengths to be used and the messages to be taken one after the other.

d. It is premature. The expression "that an art" is in its infancy is a very hackneyed one but if it can be applied properly to any art it is to wireless telegraphy. The fact that the proposed regulations are unsuitable does not reflect in any way on the ability or conscientiousness of the delegates, though it would seem that it would have been advisable to consult the engineers of the various wireless telegraph companies before drafting the rules. The main difficulty, however, is that no one, no matter what his knowledge of the present state of the art, can foresee the future developments. The question of wave length and daylight absorption is an illustration of this, as is also the question of syntonized circuits. The time has not yet come for any such hard and fixed regulations as thus proposed.

6. It was also pointed out that the public had no rights in regard to wireless telegraphy, since a patent differs from a franchise in that when the public grants a franchise it gives a right in respect to something which already exists and which it owns, and it therefore has a right to make what stipulation it chooses. In the case of a patent, however, the right is not given in respect to something which the public owns, but in regard to a new creation which exists merely in the mind of the inventor, to be called into being or not at the inventor's will, and therefore a thing in which the public has no right except as it obtains one by stipulation with the inventor. In the case of wireless telegraphy the companies invested their money under the patent law contracts with the various governments, and therefore the inforcement of regulations of the character proposed without the consent of the inventors is a breach of contract.

As a result of the hearing and of representations supporting the position of the wireless companies made by a very eminent electrical engineer the Senate Committee has decided to do nothing for the present in the matter. During the hearing the fact was brought out by the committee that the proposed regulations were passed upon the assumption that interference could not be kept out, and that the U. S. Navy had already made official reports on tests of interference preventers which showed that this was not the fact. On direct question by the Senate Committee the representative of the U. S. Navy present at the hearing freely admitted that it was a fact that interference could be kept out.

Still more recently another set of recommendations has been forwarded by the Administration to the Senate endorsing the recommendation of the Secretary of the Navy that a law should be passed[1] making it an offense punishable by imprisonment for one year or a fine of $2,000 or both for a private station to continue sending when called upon to discontinue by a Navy operator, or to produce interference with a Navy station when the latter is transmitting an official message. This recommendation was not accompanied by any recommendation to the effect that the Navy stations should use any means for keeping out interference. Before the transmission of this recommendation a conference was sought with the Navy officials with a view to drafting a form of regulation which would accomplish the results sought, without placing the wireless companies at the mercy of the Government and without virtually confiscating their property but it was found impossible to obtain a hearing.[2]

The following memorandum of a portion of the interview between Secretary Straus of the Department of Commerce and Labor and the representative of the wireless company, asking for a hearing, will be of interest:

REPRESENTATIVE: "Will you not, Mr. Secretary, be willing to assist us in obtaining a treaty which, while giving the government all it desires in the way of intercommunication between different systems, reservation of wave-lengths for government purposes, etc., will at the same time avoid driving the wireless companies into bankruptcy?"

SECRETARY STRAUS: "The treaty was reported by the experts of the government departments, and we propose to carry it out, as it is the policy of the administration."

REPRESENTATIVE: "But, Mr. Secretary, these regulations virtually prevent the wireless companies from doing any commercial business. With everybody on one party line, even without the numerous other restrictions, it will not be possible to handle a sufficient number of messages to pay operating expenses, and the companies will necessarily be driven into bankruptcy."

SECRETARY STRAUS: "That has nothing to do with the department. If you are injured you should go to the Congress and ask them to reimburse you."

REPRESENTATIVE: "Mr. Secretary, you know that it would be practically impossible to get a bill to reimburse a private company through the Congress. Why should the government crush out a new and important method of communicating which will save the country millions of dollars yearly, when the government will gain nothing by the action? We feel that your department ought to assist us in this matter."

SECRETARY STRAUS: "It has been decided by the administration that the treaty should be approved as it stands."

It will be noted that this conversation took place in the United States, and not in Russia, as might possibly be otherwise inferred. It will appear from this and the experience of others that the original object of the formation of the different government departments has been rather lost sight of in recent years.

[1] Section XXXIII.

[1] Congressional Record, Feb. 14, 1908. Also H. R. bill 17719, 60th Congress, 1st Session.

[2] See also appendix.

It will perhaps be seen that the difficulties in the development of wireless telegraphy have not been wholly of a technical nature and more patience may perhaps in the future be extended to those engaged in the work.

CONSIDERATION.

The subject is, however, one which is bound to concern in the near future other branches of the engineering profession than those now affected and the present appears to be a suitable time for considering the matter more broadly.

Whatever the ultimate object of man's existence may be it is tolerably certain that it is not to occupy his entire mental activity with the question of how many grubs he can secure for food and where he can find a suitable hollow tree in which to spend the night. But whatever we have above this is due solely to the inventor (in which term I include not only the men who discovered how to produce fire and to build houses and steam engines and alternating current motors, and therefore all engineers whether they take out patents or not, but also those who discover how to distribute what is created in such a way as to make it available).

In the state of nature which Tolstoy so greatly lauds and so carefully avoids advance is impossible; all available energy of mind and body is necessarily employed in the problem of maintaining a bare existence. Before we can advance toward our goal, whatever it is, we must first have time and opportunity and a means of maintaining any advance. That we have this time and opportunity is due to the fact that by means of innumerable inventions we are rendered every day less dependent upon the accidents of nature. It would therefore appear, that whatever our ultimate goal may be, the first essential for reaching it is an increased control over the forces of nature.

This increased control can only be obtained through intense effort. When we see a performer at a circus contorting his body into apparently impossible positions we realize the peculiar aptitude and the many years of training which must have been necessary. It is not generally realized, however, that a still more peculiar aptitude and many more years of still more intense training are necessary for those who would do useful work in any branch of mental achievement. We seldom think, in reading a mathematical paper for example, that the author has studied possibly for an average of ten or twelve hours a day for twenty or forty years before achieving sufficient proficiency in his subject to be able to accomplish the work.

To obtain results in a special line therefore a man with special aptitude and training is required. In addition to this there must be the opportunity. Hundreds of thousands, and in many cases millions of dollars are necessary for the development of an important invention. Such sums will not be furnished if there is no prospect of a return. As the success of an invention is always doubtful, the return from a successful invention must be sufficient to cover the losses from the much larger number of failures, for if the average return from one hundred inventions falls below that obtainable from mortgages or other forms of secure investment there will be no incentive.

The following questions seem to me to be worthy of consideration:

1. Whether public officials, elected by the people, would consider themselves justified in expending millions of dollars on the development of inventions the success of which was uncertain.

2. Whether the best men to develop such inventions successfully would be found among the Government officials available.

3. Whether development can be expected in an art or industry entirely under Government control or ownership.

4. Whether universal Government control or ownership does not necessarily involve a fixed and non-progressive state as opposed to a state of progress and development.

In the United States some additional hindrances on the part of the Government have been met with. For example, in the United States, and in Russia, as well, an inventor has no legal remedy in case the Government appropriates his invention.[1] It might be thought that the inventor could protect himself by suing infringing companies, but this is not so.

The wireless sets originally used by the United States Navy were imported from a country which was not at that time under the Patent Convention, and as they were purchased abroad no action could be taken. The then Secretary of the Navy, Mr. Moody, refused to require the foreign company to appoint a responsible representative in America. It was not until some years later, when, Mr. Morton being Secretary and the matter having been taken up by one of the Senators, this was done, and an injunction was obtained against the representative so appointed.

On further protest the next Secretary of the Navy, Mr. Bonaparte, stated that the patents could not be recognized as they had not been sustained. He was again approached but said that he had decided that he was not bound to respect them as he considered the price too high.[2] He declined, however, to allow the price to be fixed by arbitration, stating that he considered that the price should be fixed with reference to the cost of manufacture solely. The principal infringing companies having been enjoined the Navy and Army began manufacturing the devices themselves in quantities.

Through the influence of one of the Senators the matter was again taken up and it was arranged that the Secretary of the Navy, Mr. Bonaparte, should obtain a legal opinion from the Attorney-General in regard to the matter. This opinion was prepared by one of the Attorney-General's assistants and proved to sustain the claims of the wireless company on every point. Before it was finally transmitted the Secretary of the Navy, Mr. Bonaparte, withdrew his request for an opinion.

The wireless company received a letter[3] from the Navy Department to the effect that by order of the Administration the patents had been turned over to the Navy Department. A written request[4] was forwarded to the Administration, pointing out that the above-mentioned property had been confiscated by the Government without a hearing and asking for a hearing. No reply was received.

The above is given as an illustration of the effect of the present law under which an inventor has no legal remedy against the confiscation of his patents by the United States Government. Among other recent instances of confiscation of inventions by the Government may be mentioned those of the Krupp and Armstrong Companies, the San Francisco Dry Dock, etc.

As the situation is not generally understood attention is here called to it. It should be remedied, as it operates very injuriously as regards the Government departments themselves. The Government is deprived of the services of American inventors who either place their talent at the disposal of other countries, as in the case of Hiram Maxim, or turn their attention to other lines. The general result is that the United States Government, instead of leading other nations, is obliged to follow after and copy, though the success of the United States Navy in developing submarine boats is an illustration of what can be accomplished in cases where the inventor has been able to develop his work without confiscation.

In 1906 President Roosevelt's attention was called to the above facts. He was asked if the administration would not introduce a bill to remedy this state of affairs. He replied that the administration had too many bills of its own to look after, but, on further inquiry, stated that if such a bill was introduced the administration would not oppose it.

[1] Russell vs. United States, decided in 1900, 182 U. S. 516.
[2] Letter April 19, 1906.
[3] Letter No. 137,244, July 11, 1906.
[4] Letter April 3, 1907.

On the strength of this promise a bill was introduced and unanimously reported, as follows:

HOUSE OF REPRESENTATIVES, 60TH CONGRESS, FIRST SESSION, REPORT NO. 184.

The committee on patents, to which was referred the bill (H. R. 7653) to amend section 4919 of the Revised Statutes of the United States, to provide additional protection for owners of patents of the United States, and for other purposes, has considered the same and recommends that the bill do pass with the following amendment:

In line 7, page 1, strike out the words "has been or," and insert the word "hereafter" after the word "shall."

A bill substantially the same as that now reported was passed by the Senate at the last Congress, and favorably reported to the House, but at too late a day in the session to receive consideration.

The object of the bill is to provide for owners of United States patents a remedy for the taking of their property by the United States for public use, when such taking occurs without the license or authority of such owners and without compensation.

In England and in practically all our civilized countries, except Russia and the United States, the government cannot appropriate an invention without paying a fair price for it. A regular tribunal is charged with the duty of determining what is a fair price for the use of an invention appropriated by the government in case the government considers the inventor's charge to be excessive. The United States habitually appropriates at its pleasure the patented inventions of its citizens and declines payment therefor. And this notwithstanding the fact that according to the decisions of the Supreme Court a patent of the United States is property within the meaning of the term as used in the constitution and laws of the United States, and the use of a patented invention by the government is a taking of private property, which can not be done lawfully without compensation to the owners. (Solomons *v.* United States, 137 U. S., 342, 346; McKeever *v.* United States, 14 Ct. Cls., R., 396; affirmed S. C. 18 Ct. Cls., R., 745.)

But notwithstanding this right to protection which patentees and other property owners derive from Article V of the Amendments to the Constitution, it has been held by the Supreme Court that the owner of a patent can not restrain its infringement by the United States or an officer or agent of the government. (Schillinger *v.* United States, 155 U. S., 163 (1894); Russell *v* United States, 182 U. S., 516 (1900).)

In both of these cases the court held that in the absence of an express contract between the government and the patentee, or transactions between them from which a contract may be implied, no court of the United States is vested with jurisdiction to entertain a suit or action by a patentee seeking to recover compensation for the use of his invention by the government.

How next to impossible it would be to make a case of implied contract which would render the government liable under the court's decision may be inferred from the following statement of the facts appearing in the Russell case just cited. It there appeared that at the government's invitation Russell exhibited his patented invention to a board of officers appointed by the Secretary of War. The government announced that it would adopt and use a device embodying his invention. Prior to the adoption and use of the device Russell communicated his patent to the War Department, showing that his patent covered the device and tendered the use of his invention to the government for reasonable compensation. The government proceeded to use the device without denying Russell's right to compensation, but with the remark that he should seek his remedy by some means other than executive action. And the Russell case is only a sample case; one of many.

It seems to be necessary and proper to provide for patentees a remedy, such as the passage of this bill will secure, for the invasion of their rights. Without such remedy, patentees are the only persons who are outside the protection of Article V of the Amendments of the Constitution. "Nor shall private property be taken for public use without just compensation."

Without such remedy a patent is not what it purports to be on its face. Many inventors have spent years of their lives and practically bankrupted themselves in developing inventions primarily of use to the government, only to find in the end, after their property has been seized by the government, that they have no legal means of redress, and that the governmental departments will not recognize the decisions of the courts.

Without such remedy there is a ridiculous discrimination between inventors. The inventor of a children's game or of a new brand of chewing gum is protected by the courts. But the inventor of a device which may save the nation from a humiliating defeat in time of war, or reduce the cost of carrying the mails, or reduce the number of shipwrecks on the coast, is afforded no protection; the governmental departments have the power to confiscate his property and habitually exercise that power. It may be a new type of breech mechanism, or a dry dock, or a method of communicating with ships at sea; if the invention is valuable the government can and does seize it, though the inventor may have spent years of his life and bankrupted himself and his friends in developing it.

It may be conceded that the government ought to have the right to appropriate any invention necessary or convenient for natural defense or for beneficent public use, and that, too, without previous arrangement or negotiation with the owner. Nevertheless, the appropriation having been made it would seem that justice to the citizen demands that in due time he should receive fair compensation for his property.

The claim is made by some that the government, being the grantor of the patent, ought to have the right to use without compensation such inventions as are necessary for its purposes.

One answer to this is that there is no such limitation or reservation in the law governing the granting of patents; and another answer is that if that were the law there would be no time, brains, or money spent by any one in inventing those things for which there would be no remuneration.

But it is useless to multiply reasons to justify the passage of the bill. The one fundamental reason already assigned is unanswerable—that no American citizen's property can be appropriated for public use by the government or by any one else without compensation being made therefor.

The amendment proposed, by striking out the words "has been or" and the use of the word "hereafter," in line 7, page 1, is deemed advisable, that there may be no question arising upon statutory construction that the law is not retroactive in its effect, but will apply only to future appropriations of patents by the government.

It passed the House of Representatives by a large majority, the leaders of both the Republican and Democratic parties speaking in favor of it. It passed in the Senate unanimously. It did not become a law, however, as President Roosevelt declined to sign it, though its signature was strongly recommended by Secretary Taft, Senator Knox, and others. No reason was given by President Roosevelt for declining to sign the bill, but it is understood that his action was due to the fact that the ratification of the proposed wireless treaty had been opposed by one of those interested in the passage of this bill.

A WORD OF FRIENDLY ADVICE TO OPERATORS.

LET us give a word of friendly advice to the telephone girls—if they care to have it, says the Chicago *Examiner*. They have their hardships which are not appreciated any too generally by the people whom they serve. They can make it easier for themselves and they can gain the good wishes of the subscribers by one simple thing: Let them make a resolution never to be other than good-natured.

It takes two to make a quarrel. No man, let him be as surly and bad-tempered as he will, can get into much of a passion or stay in it long if he has nothing to fight. The telephone operator who is invariably cheerful, polite and accommodating, quickly smooths the ruffled feathers of the most testy subscriber.

A low voice, saith wisdom, is an excellent thing in a woman. That is as true now as when it was first written. Never to become strident, angry or high-pitched; never to be other than soft and pleasant and well modulated—these are the signs by which you may know the gentle woman's voice. Such a voice disarms anger, repels insolence, makes the rough places of daily business smooth.

Let it be remembered that the telephone is nowadays the vestibule, so to speak, of practically all human activity, commercial or social. The whole world talks through the telephone. Men, women and children, saints and sinners, wise men and fools—mankind and his cousins—use the wires.

The operator at the switchboard with the receiver at her ear is the moderator, so to speak, of this heterogeneous multitude. She can keep it in order and in good temper, or she can permit it to become the dwelling place of unkindness and vexation of soul.

Let her soothe the crank, placate the professional grumbler, and ignore the bully.

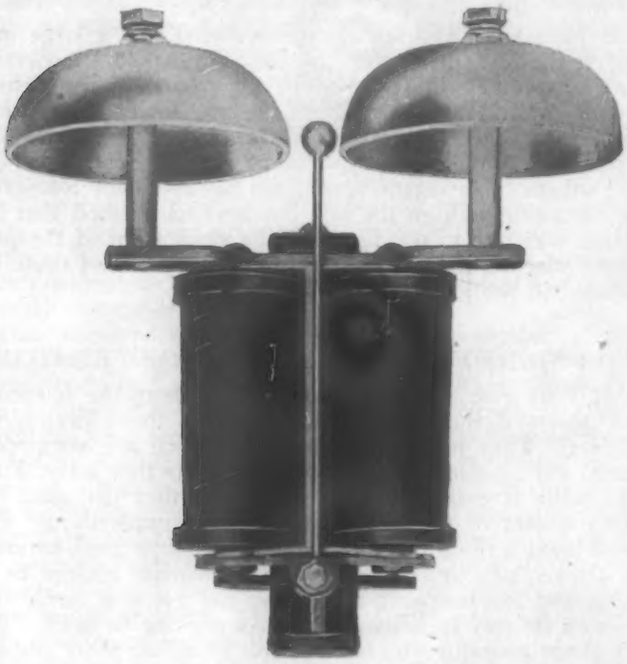
Let her, in short, be just, as well as amiable, considerate as well as courteous. Thus shall she do society a service and help the world go round. So shall those who deal with her over the wire come to take their tone from hers, and finally laud her with that highest praise: "This operator at the switchboard is all right."

Manufacturer's Department

By W. H. Graffis

CRACRAFT, LEICH RINGER.

ONE of the noticeable pieces of apparatus of the new Cracraft, Leich accessible telephones is the polarized ringer. Particular attention has been paid to the adjusting features. In order to adjust a ringer properly it is necessary to have the proper clearance between the clapper ball and the gong after a satisfactory armature stroke has been obtained. This necessitates a close examination of the



Cracraft, Leich polarized ringer.

clapper ball and gong while the gong is being brought in the proper proximity of the ball. In the Craft, Leich self-contained ringer, this adjustment is obtained, it is said, in a unique manner. The gong standards or studs are riveted solidly into the heel iron, insuring absolute permanency. The hole in the gong is drilled a trifle off center, making it possible to obtain any desired adjustment by simply turning the gong under the lock nuts before it has been securely clamped. The gong is held permanently in its proper position by a double lock nut, after having obtained the desired adjustment.

A screw-driver is all that is necessary for the armature adjustment. It is of the spring type, the details being plainly shown in the accompanying illustration. The adjusting screws extend to the outer end of the permanent magnet which is provided with a hole sufficiently large to accommodate an average sized screw-driver. The threaded portion is screwed into a hexagon brass rod extending through the heel iron and there fastened in such a manner as to prevent the rod from turning while adjusting the armature. The armature is provided with freezing points which are of uniform thickness. The edges of the cores are slightly rounded to prevent the armature iron from coming in contact with the iron of the core to guard against freezing.

The spools are of a good size to accommodate winding space for a large size of wire for a given resistance. This results in more turns per unit resistance, greatly increasing the impedance of the ringer, which is a very important factor when used in connection with heavily loaded bridging lines. The magnet is of a size best suited for average commercial service. When the permanent magnet is too strong, it will cause the armature to stick with a given air gap between the armature and core, determined by the freezing point. A weak magnet under the same conditions will materially decrease the efficiency.

THE MONARCH RELAY.

THE remarkable success of the Monarch Telephone Mfg. Company, Chicago, in making apparatus that is convenient and easy to take apart and reassemble is exemplified in a forcible manner in the Monarch relay. The extraordinary simplicity of this piece of apparatus is a wonderful achievement in designing. The relay is so compact that it requires but very little space for mounting, yet any part can be reached easily and the entire relay can be disassembled within a remarkably short time without using a tool of any kind. A complete relay, detached from the mounting strip, and with the cover removed, is shown in Figure 1. The cylindrical cap, which is made of iron, coppered and with a black finish, is provided with bayonet slots. These slots engage pins on the relay frame and a slight turn loosens the cap so that it is free to be removed. The cap fits so perfectly that it excludes all dust from the working parts. The locking lever which holds the arma-

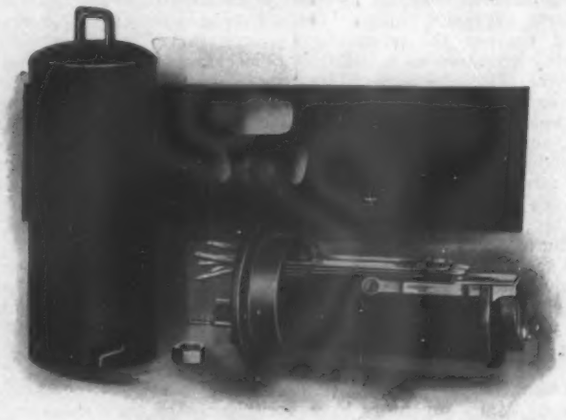


Figure 1.

ture in place can be raised as shown in Figure 2, and when so raised the armature is at liberty to be taken from the two pins which support it. Although the coil fits closely around the core it is a separate part and when the armature is removed the coil can be slipped off.

The armature is supported by a Norway iron bridge which is rigidly mounted on the same frame which supports the core. This insures the relation between the armature and the core being always the same and consequently there is no chance of the adjustment being altered in reassembling or by other cause. The bridge which supports the armature is joined to the frame end of the core and at the

other end the armature provides the connecting link between the two parts, completing a perfect magnetic field. The danger of "freezing" is eliminated by the brass adjustment screw which can be seen in either illustration and which extends through the armature and prevents actual contact of that part with the core. The adjustment screw is provided with a lock nut to insure permanency of adjustment. The iron parts are given a copper finish to

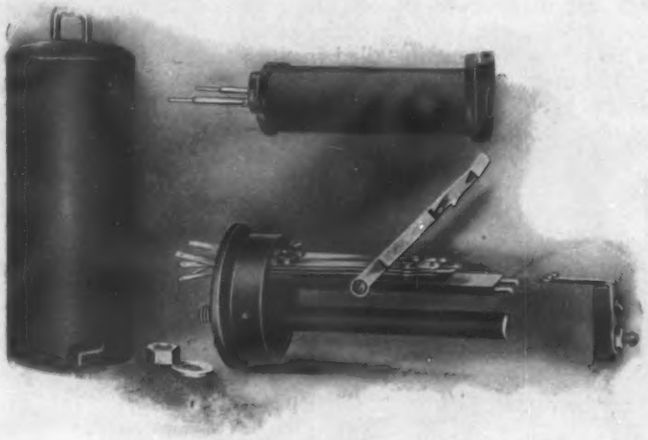


Figure 2.

prevent rust and the German silver contact springs are provided with pure platinum contact points. The pins upon which the armature rests are of non-magnetic metal in order that the easy action of the armature may not be retarded by magnetism in these supports. The horizontal arm which extends from the top of the armature and operates the contact springs is prevented from coming in metallic contact with them by hard rubber bushings which form the bearing points. The relay is so constructed that a change can be made from single to double springs, or vice versa, at any time and any combination of springs can be used. The mountings are arranged so that either single or double windings can be used in the relay.

NEW BELDEN CATALOGUE.

THE Belden Manufacturing Company, Chicago, has recently issued its new No. 4 catalogue. It is a convenient pocket size containing 124 pages, printed on fine paper and profusely illustrated. Evidently great pains have been taken to produce a simple and comprehensive book on wires, cables, cordage and other electrical raw material required particularly by users of wire. Each article listed is described and illustrated wherever possible, showing the construction and the manner in which it is prepared for shipment. A feature of special interest to telephone companies is the section devoted to telephone cordage. Eleven styles of receiver cords are described with separate illustrations showing different arrangements of terminals, stay cords, tips and clips to fit all standard types of receivers. Prices are quoted for each one of these styles made up in twelve different combinations of length, coverings so that by simple reference to the code word, a telephone company can order and be certain of receiving cords made exactly to fit its receivers without giving a semi-technical description. Switchboard cords are also listed with dimension drawing showing different finishes of plug end to fit twenty-two different makes of plugs which solves the problem of ordering and receiving switchboard cords correctly finished. A number of new products are listed which have not heretofore been manufactured by the Belden company. Among them are rubber covered wire, weather proof wire, copper clad drop wire, bare copper clad wire, iron and steel telegraph wire, platinum and spring brass wire, norway iron core wire, braided copper cables, stranded copper cables, insulating compounds, beeswax and paraffine, armature banding wire, dry tapes and webbings, adhesive tapes, steel gains, ground clamps, wire test connectors, new cordage, new terminals, lock stitch twine, paper splicing sleeves.

Twenty-five pages are devoted to wire tables and formulas useful in the design of electromagnets, resistance coils, cables, etc. These formulas and tables involve only arithmetical calculations and should be of great assistance to those engaged in the design of windings. Copies will be sent free to those engaged in the electrical business, on application to the Belden Manufacturing Company, 194 Michigan street, Chicago.

THE STROMBERG-CARLSON JACK BOX.

THE Stromberg-Carlson Company's No. 882 iron clad jack box combines the several necessary features required for an outdoor terminal station for connecting telephones used with dispatching systems paralleling interurban and steam railways. The form of housing for the terminal springs and fuses ensures strength, and although thoroughly protecting the enclosed apparatus from moisture is designed to be readily moved. The top dome-shaped casting is turned half around to remove after taking out a dowel pin, permanently locking the jack box by use of a regular switch lock.

The frame casting supporting the terminal springs and fuses also separates these parts to protect the springs from the arc caused by the burning of the arrester fuses. The heavy contact springs are rigidly mounted in hard rubber

Stromberg-Carlson jack-box, closed and open.

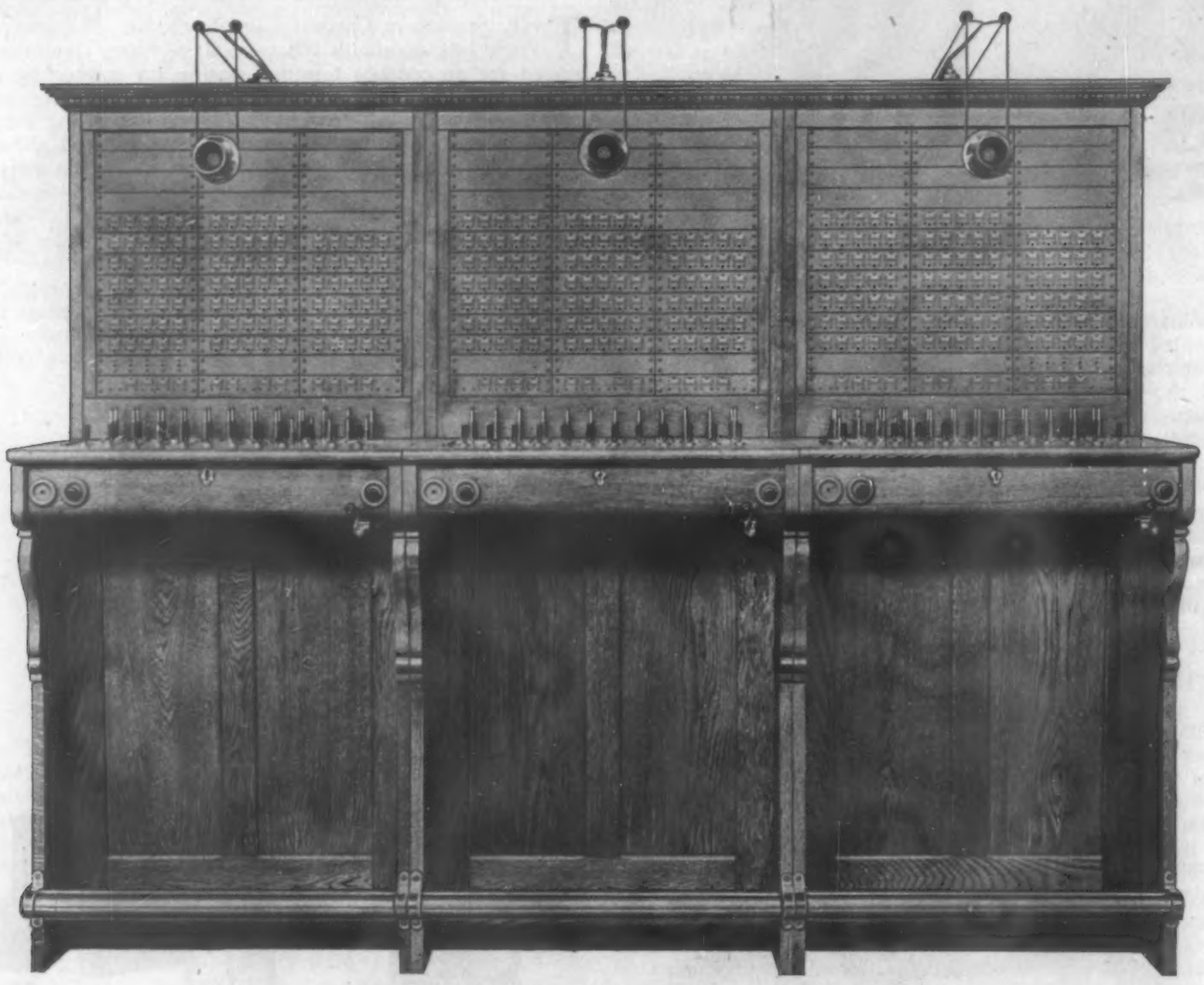
with a maximum separation between springs to afford proper insulation. The opening for the connecting plug is covered until met by the plug when "plugging-in" by a spring trap door which covers the opening until pushed up as shown in illustration of the open view of jack box.

Porcelain bushings are provided for the connecting wires and heavy lag screws with washers for mounting on poles or flat surfaces as required.

The Stromberg-Carlson Telephone Manufacturing Company reports that many favorable comments have been received from numerous customers who are using this new device. Further particulars and prices will be furnished upon application to the company at Rochester, N. Y.

STROMBERG-CARLSON SWITCHBOARD FOR ITALY.

THE popularity of the new self-restoring drop recently put on the market by the Stromberg-Carlson Telephone Manufacturing Company of Rochester and Chicago, is attested not only by the many orders received from operating companies in this country for switchboards equipped with this new style of line signal, but from foreign countries as well. The three position switchboard in the accompanying illustration shows an equipment of this type recently shipped by the above company for use at Bari, Italy.



Stromberg-Carlson 450 drop switchboard shipped to Bari, Italy.

The switchboard woodwork is of rigid construction, consisting of three sections of the company's A-1686 cabinet, as modified for self-restoring drop equipment and finished in golden oak. Each section is supplied with a brass foot rail; the plug shelf is covered with the best quality of heavy belt leather, and the interior so arranged as to make all the apparatus readily accessible. Each section is wired for an ultimate of 150 self-restoring drop lines, 100 of which are at present equipped. Twelve cord pair are supplied for each position, the first being wired for repeating coil circuits. The transfer equipment is of the plug and jack end type, each position having an ultimate capacity of fifteen outgoing and fifteen incoming transfers. Associated with the plug, or incoming end of each transfer is a supervisory signal lamp designed to operate upon an eight volt battery. Of the transfer equipments, five outgoing and five incoming are at present installed in each of the first and third sections. For use in connection with the transfer circuits wiring for five order wires is included in each position with one order wire key at present installed in the first and third positions.

The operator's equipment is of the usual suspended transmitter type, consisting of a standard 8-B transmitter suspended from an arm readily adjustable either as to height or distance from face of board, and a 15-A receiver, with leather covered head band and concealed terminals. The operator's jacks may be seen on the rail below the keyboard at the left of each position.

Directly beside each operator's jack will also be noted a switch for closing the night bell circuits when desired. At the right of each position and mounted upon the same rail are the switches used for changing from hand to power generator.

The line circuits enter the board by way of cables extending fifteen feet from the base of the first section, while the transfers order wires and miscellaneous circuits are terminated on neat terminal strips located in the rear of each section.

NEW GRAY PAY STATIONS.

THE photographs reproduced here show two new types of pay stations which have recently been brought out by the Gray Telephone Pay Station Company of Hartford, Conn., to be used in connection with automatic telephone

Gray pay station for automatic wall telephone.

systems of the full common battery type. The first shipment of these machines has recently been made to the Home Telephone Company of Portland, Oregon. The gravity principle is used in these new types in the same manner as in the regular line of Gray pay stations. The

Gray pay station for automatic desk set.

user simply drops the money in the slot and the signals are sounded by the falling coin. This feature is especially desirable where pay stations are to be used on automatic systems as there would be a tendency to confusion with the proper manipulation of the calling dial, if other functions than the deposit of the coin were required of the user. This fact is also true from an operating standpoint as there is a considerable saving of time where the user is not required to operate levers or buttons.

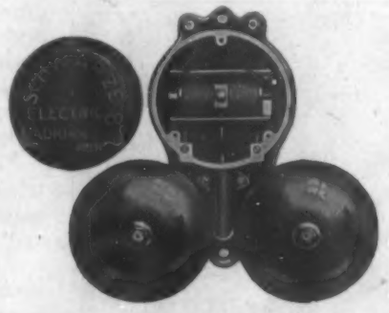
The maintenance cost on these machines is reduced to a minimum, there being no movable parts or springs to wear or get out of order. The simplicity of construction warrants the most satisfactory service. From the inquiries the company is now getting on this piece of apparatus a large volume of business is expected. The device has a broad field of operation, and is needed in the telephone field.

The Gray company is doing an excellent business in its regular line of pay stations, which are giving the usual satisfaction. The long experience of the company in the design of devices of this nature is ample assurance to the telephone world that the new pay station will fulfil the promises made for it.

SCHWARZE BELLS.

THE Schwarze Electric Company, Adrian, Mich., is making a feature of its loud ringing magneto extension bell, a photograph of which is reproduced here.

In designing this bell the company has embodied a combination of features to produce a bell of the same high efficiency that has characterized its general line of signal bells. The spools are large enough so that in no case is it necessary to use smaller than No. 35 magnet wire, thereby obtaining the maximum number of ampere turns, and



Schwarze loud ringing magneto bell.

this wire is all active. The armature is under the influence of the coils its entire length. The poles are arranged in such a manner that the permanent magnet cannot be discharged, and will not weaken. The apparatus is enclosed in a metal case, making each bell weather-proof. Gongs are applied in all sizes from six inches to ten inches, inclusive.

These magnetos are designed to be used for common signal work where alternating current is used, such as sixty cycle and above, when wound to ten ohms. They can be used on 110 and 250 volt circuit with incandescent lamps in series similar to the company's Universal bell. Where electric lights are used any one can use this bell on alternating current light circuit in place of a bell which requires a battery for operation.

Since manufacturing the large loud ringing magneto extension bell, which has proven very satisfactory to the trade, the company has had many calls for smaller magneto extension bells, and is now placing on the market a smaller bell of the same type. This bell will operate perfectly on sixty cycle alternating current and higher. It is not only a splendid telephone bell, but when specially wound, can be used on high tension alternating current of sixty cycles for house and factory signaling.

A direct current bell for selective signaling is also put out by the Schwarze company. This bell was specially constructed for the Clay Centre Telephone Company, of Clay Centre, Kan., and is now used by exchange managers who desire an effective and economical selective system. A

master ringing key and a source of direct current supplies the only extra apparatus necessary. It is claimed for the company's telephone ringer that it requires no relays of batteries on any length of line, and will operate over one mile of No. 18 copper wire on two dry cells of battery.

The Schwarze Universal bell, referred to above, is claimed to possess the following new features and qualities:

Does not open the circuit. Does not arc nor burn out contact points. No adjustment or retractile springs used to work against magnet strength. Will work with direct current of any voltage. Operates with either battery or dynamo currents. Can be used on series or multiple lines. No permanent magnets used. No self-reaction in coils. A constant flow of current in one direction. No pulsations or reactions in coils. Being constructed weather-proof, it requires no housing or other protection.

Literature and price lists of Schwarze bells and ringers will be furnished interested readers of TELEPHONY upon application to the Schwarze Electric Company, Adrian, Michigan.

THE SEPTEMBER MOORE CALENDAR.

STILL another of those exquisite little calendars, and Labor Day is the particular "answering jack" that the fair damsel on the calendar has connected the Moore cord with. Labor Day means more than a holiday; it means cool, brisk, energetic weather and increased activity overhauling the exchange. Mr. Moore says:

"Have you tried our cords packed in standard packages?

"They are put up in neat pasteboard cartons, holding twenty-five or fifty cords, plainly labeled and packed to occupy minimum space.

"The cords could not be improved — we now think the package is worthy of the cords, the latter are kept clean and fresh no matter what the surrounding conditions may be.

"Economical, isn't it?"

SCHUETT MANUFACTURING COMPANY PROSPERING.

SALES of Schuett self-welding wire joints are increasing by leaps and bounds, according to reports from the Schuett Manufacturing Company, 17 West Madison street, Chicago. The valuable feature of the Schuett joint lies in the fact that the act of twisting it, with the two wires in place that are to be connected, binds the two sleeves of the connecter so tightly about the wire as to make the connector and wire into a practically solid piece of metal, which fact naturally prevents the entrance of moisture or even air. This, and the ability of the joint to form a satisfactory connection between two wires with a difference of two gauge numbers in size, is said to be proving very attractive to practical telephone men.

The company is sending out some interesting literature describing the features of the joint and illustrating a number of comparative tests of Schuett and other joints. Telephone men will do well to send for circulars and samples.

E. O. MUNSON.

THE Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has appointed an assistant advertising manager in the person of E. O. Munson, formerly of the company's Rochester sales department.

E. O. Munson.

Mr. Munson was born in Chicago in 1882. After graduating from high school, he went to Rochester, finishing a course in the Rochester Business Institute in 1901. He immediately entered the employ of the Bell Telephone Company of Rochester as solicitor and claim agent, entering the employ of the Stromberg-Carlson company when its plant was moved to that city from Chicago. After a year's experience in the switchboard departments he joined the sales department to handle orders and prices. For a year he travelled the state of New York, and was later made territorial salesman and correspondent and detailed in various special classes of salesmanship. He continued this work until taken into the advertising department as assistant manager, the place being created by the recent doubling of that department by the Stromberg-Carlson company.

Mr. Munson has made a great many friends in the telephone field, and will prove a credit to his new place.

H. H. DAVENPORT & COMPANY GETS LARGE CONTRACT.

H. H. DAVENPORT & COMPANY, of Amarillo, Tex., engineers and contractors for the Panhandle Telephone & Telegraph Company, a corporation organized under the laws of Arizona with a paid-up capital of $500,000, and with a permit to do business in the state of Texas, are installing a first-class exchange in Amarillo, Texas, in which 100,000 feet of cable, 36,000 feet of conduit and a full multiple 1,200 line common battery board is being used. The pressed brick and stone building, which is being constructed especially for the purpose, will be one of the best buildings in the city and will have every modern convenience.

MONUMENT TO JOHN A. ROEBLING.

THE photograph which is reproduced herewith shows the impressive monument which was unveiled June 30 at Trenton, New Jersey, to the memory of the founder of the John A. Roebling's Sons Company. It presents in

The Roebling Monument.

heroic scale a striking likeness of the great engineer as he was wont to sit, wholly engrossed in the pondering of some mighty engineering problem. The statue is of bronze, mounted upon a massive granite pedestal. Upon the base are bronze tablets representing pictorially some of the great works of Mr. Roebling. TELEPHONY for August contained a description of the monument and ceremonies.

SUIT OVER ANCHOR PATENTS.

GEORGE H. HYLAND, 229 North Seventh street, Hamilton, Ohio, is sending the following notice to the telephone trade: "As owner of the Stombaugh patent No. 501,811, I have entered suit in the United States Circuit Court at Cincinnati, Ohio, against the Philip Smith Manufacturing Company of Sidney, Ohio, who are manufacturing the so-called Widmer Land Anchor, which are now sold to the trade as the Stombaugh Anchor, by W. N. Matthews & Brother, 219 North Second street, St. Louis, Mo.

"You are hereby notified that such anchors are an infringment of said Stombaugh patent and all persons selling or using the same are guilty of an infringment of said patent and will be held strictly liable therefor. Please govern yourselves accordingly."

AN INTERESTING PUBLICATION FREE.

THE Automatic Electric Company, Chicago, has had reprinted for distribution among telephone men the paper presented by Mr. W. Lee Campbell at the twenty-fifth annual convention of the American Institute of Electrical Engineers at Atlantic City, New Jersey, June 30, 1908, entitled "A Study of Multi-Office Automatic Switchboard Telephone Systems," and will be pleased to send copies of this paper gratis upon request.

ROBERTS' SERVICE.

THE Homer Roberts Telephone Company, of Chicago, Illinois, has recently installed several additional telephones for the Eau Claire Telephone Company, of Eau Claire, Pennsylvania. The telephones supplied were of the standard Roberts selective ringing, lockout type for party line service. The fact that this is the third order filled for this company decisively proves the class of service it is said that the Roberts telephones have been giving.

The first telephones were installed at Eau Claire during the last winter and the latest reports show that the company has not yet had a single case of instrument trouble. Although some of the ground wires have been burned off by lightning, none of the instruments have been damaged, which result is due, to a great extent, to the fact that the new Roberts "Self Cleaning," lightning arresters have been installed on these telephones from the very first.

ERICSSON RECEIVER OFFER.

THE L. M. Ericsson Telephone Manufacturing Company of Buffalo, N. Y., is employing a unique method to increase the number of names on its books. The offer is in the form of a straight ten per cent discount on several types of receivers manufactured by the company. Ericsson receivers have always been noted for their excellent qualities. L. M. Ericsson invented the first bipolar receiver in 1879 and the Ericsson company claims that no duplicate, for efficiency, of this receiver has ever been made, although several duplicates in the way of appearance have been made from time to time. The Ericsson company uses a steel of its own manufacture which it claims will retain magnetism longer than other steel. The quarter century record for supremacy which Ericsson receivers hold is pretty good evidence of their excellency. Readers of TELEPHONY will no doubt find room for receivers in quantities since a ten per cent discount means a saving not to be lightly set aside.

Perhaps some of our readers remember the first bipolar receiver. It was the identical No. 1 receiver manufactured by the Ericsson company today, excepting in the covering. This was leather, but hard rubber was soon found to be much more economical, and was adopted.

In order to supply the demand for an all rubber receiver of standard design, which should retain the good qualities of the No. 1 and have binding posts concealed, the Ericsson company developed its No. 2 receiver. This has become extremely popular because of its perfect receiving qualities and graceful design.

The No. 4 Testing receiver, included in the ten per cent discount offer, is on par with the others. It is extremely

powerful and sensitive and servies admirably both as a transmitter and receiver.

Operating companies throughout the country are generally familiar with the fine qualities of the Ericsson operator's receiver. It is very light and has a spring tempered, perforated head band, with a ball and socket joint. This makes the receiver fit snugly to the head while at the same time it allows the operator the greatest possible comfort.

TELEPHONY readers in need of receivers should take advantage of this offer. Prices and conditions will be noted on the colored insert of the Ericsson company in this edition of TELEPHONY.

MONARCH ELECTRIC & WIRE COMPANY'S NEW CATALOGUE.

THE Monarch Electric & Wire Company of Chicago, Ill., has ready for distribution its new and most up to date catalogue which is said to contain every new article known to the electrical trade up to the date of its completion.

In presenting this catalogue to the trade, it has been the company's chief aim to produce an illustrated rather than a descriptive catalogue. The catalogue contains about 900 pages and unusual care has been exercised in preparing the illustrations, in this way giving a much better idea of appearance and construction than would be possible with descriptive text alone.

Copies will be mailed to all interested parties upon mentioning TELEPHONY.

BLAKE SIGNAL IS PRAISED.

THE Blake dispatcher's train order signal, as manufactured and sold by the Blake Signal and Manufacturing Company, 246 Summer street, Boston, Mass., appears to be giving considerable satisfaction. The Evening *Capital*, of Annapolis, Maryland, August 1, 1908, under the caption "Official Route of Red Men—Washington, Baltimore & Annapolis selected to transport next Tuesday's crowd" contains the following:

"In selecting the route the officials were impressed with the high degree of safety with which the single track section, between Naval Academy Junction and Annapolis, has recently been brought by the installation of the Blake signal system. * * * A demonstration of the working of the Blake system on the single track convinced them that the Annapolis Branch was equally as well protected against accident as the double track portion of the road."

SOME LARGE ORDERS RECEIVED BY THE MILLER ANCHOR COMPANY.

THE Miller Anchor Company, Norwalk, Ohio, reports a very prosperous season, having filled the following orders: The Washington, Baltimore & Annapolis Electric Ry., 3,650 mixed sizes; the Chesapeake & Potomac Telephone Co., 7,000 No. 2s; the North Electric Co., Dallas, Texas (carload), about 3,000 all sizes; the A. L. Register Co., 1,080, Nos. 1s and 2s; the Bell Telephone Co., Milwaukee, 6,500 No. 2s; the Union Telephone Co., Alma, Mich., 800 No. 3s; the Bell Telephone Co., Detroit, 4,500 No. 2s, and the Chicago & Milwaukee Traction Co., 2,000 No. 3s. This anchor is becoming quite popular on account of its cheapness and adaptibility for various purposes. A large stock of the different sizes is always on hand and orders are given prompt attention.

ROSS-HULL ELECTRICAL SUPPLIES.

AN enterprising telephone supply house is the Ross-Hull Electrical Company of Columbus, Ohio. The company handles a general line of telephone supplies, and by virtue of giving strict attention to the demands of its customers, handling only the best supplies, and making a specialty of seeing that full satisfaction goes with every order filled, has succeeded in building up an enviable business. Quick telephone service is a specialty of the Ross-Hull Company, which means that all orders received will be given the most prompt attention possible, and the line handled is complete. Readers of TELEPHONY and telephone men generally when in the market for anything in the line of electrical machinery or apparatus, telephone supplies, etc., will do well to write the company stating their wants fully, and all information, prices and estimates will be furnished at once.

TRADE NOTES.

H. G. SHALER, secretary of the Doubleday-Hill Electric Company of Pittsburg, died in that city on July 18th.

EVAN S. SHELBY has resigned his position with the Sterling Electric Company of Lafayette, Ind., and will engage in the automobile business at Crawfordsville, Ind.

THE AMERICAN CONDUIT COMPANY, East Chicago, Ind., has closed a contract for 125,500 feet of bituminized fiber conduit for the Lincoln Park commissioners of Chicago, Illinois.

THE NEVER-SLIP WIRE GRIP, the invention of George H. Glass, manager of the Citizens' Telephone Company, of Pekin, Ill., and G. H. Vint, foreman of construction work, is making a great hit and orders are coming in from all over the country.

THE PEIRRE SPECIALTY COMPANY, of Elkhart, Ind., announces the discontinuance of its selling arrangement with A. L. Haase, of Chicago. In the future, Mr. Haase will have no connection with the company, either as an employee or agent. Orders may be mailed direct to the company's general office at Elkhart, or to your regular jobber.

THE DUPLEX METALS COMPANY, of New York, has opened a Chicago office at 1261 Monadnock block, with H. D. Currier, western representative, in charge. Mr. Currier was formerly associated with the Western Electric Company and various Independent telephone manufacturing concerns and is widely known throughout the telephone and electrical fields.

MR. DUGALD C. JACKSON, professor of electrical engineering in the Massachusetts Institute of Technology, Boston, spent part of August in Chicago, where he was called as a technical adviser of the city of Chicago in the matter of preparing a scientific system of keeping accounts between the city and the Chicago Telephone Company under the new telephone ordinance.

THE CENTRAL ELECTRIC COMPANY, Chicago, is distributing a booklet entitled "A Few Suggestions on Methods of Constructing Telephone Drop Circuits," and also calling special attention to its Universal porcelain insulators for this purpose. A considerable number of illustrations are employed, showing the various methods of attaching the insulators to cross-arms, poles and walls.

THE MASSACHUSETTS CHEMICAL COMPANY of Walpole, Mass., has entered into contract with one of the great insulated wire and cable manufacturers to supply its entire requirements of cable cloth. The wire and cable concern in question has for many years made its own cable cloth, but has been convinced that by delegating this work to the Massachusetts Chemical Company, whose exclusive specialty is insulating compounds and the impregnating of fabrics with them, it will get not only a better and more uniform product, but get it at a lower cost than that at which it has been producing it itself.

FORT WORTH MANAGER RESIGNS.

LLOYD E. KNAPP, manager of the Fort Worth Telephone Company, of Fort Worth, Texas, who has resigned that place, is remaining with the company a short time longer to complete the installation of service in the stock yards and packing houses for which he recently closed contracts.

Mr. Knapp went to Fort Worth from New York, where he edited a telephone and electrical paper. So pleased is he with the outlook in that section that he will go into the telephone and electrical supply business in Fort Worth, opening his establishment in a short time.

Since assuming charge of the Home Telephone Company less than a year ago, Mr. Knapp has added many features to telephone service in Fort Worth. The first of these was the installation of a sermon service, "shutins" being enabled to enjoy the entire service at their church by merely taking down the receiver and asking connection.

A telephone baseball service, a portable telephone for use in sockets at barber chairs, cafe tables and other pláces were other innovations and the "busy" service by which inquirers are notified when a line is open after being sought while busy are other improvements installed by Mr. Knapp. A physician service under which doctors notified central when they left their offices and had telephone calls answered from the exchange was another pleasing feature.

The special service established to the Coliseum during the Bailey convention, by means of which a local newspaper was enabled to report the proceedings in Fort Worth as they took place at the Coliseum, caused much comment at that time.

John W. Clifton, former wire chief of the company, becomes superintendent.

NEW BOOK ON CONSTRUCTION.

TELEPHONE Construction: Methods and Cost. By Clarence Mayer. 294 pages, 103 illustrations, 157 tables. Six by nine inches. Cloth. Price $3 net. Myron C. Clark Publishing Company, Chicago and New York.

The methods and cost of doing telephone work, cost keeping systems for telephone construction and estimating telephone construction costs are treated in this book. Covering as it does a field that has never been covered except in the most cursory manner, this book should prove invaluable to telephone men, to contractors for telephone work and to telephone manufacturers.

It has been the endeavor of the author to furnish costs of all divisions of telephone construction in such a manner that the data could be used by others in determining the cost of telephone work in any location and under any conditions. In carrying out this purpose the book is divided into eight chapters and two appendices, describing and illustrating the methods and cost of construction and giving rates of wages, kinds of soil and other details that effect the cost of work, so that the cost tables may be readily revised where rates of wages, construction methods and other conditions differ from those on which these tables are based.

In the opening chapter, Methods and Cost of Pole Line Construction, the author gives a convincing presentation of the advantages of cost records to telephone companies and to contractors for telephone work, and presents a simple and comprehensive system for collecting, analyzing and recording telephone costs. Successive chapters describe and illustrate methods and cost of cable construction, methods and cost of cable splicing, methods and cost of removing old line and of reconstruction, methods and cost of underground conduit, detailed cost of constructing 824,862 duct feet of underground conduit and 318 vaults in one job, miscellaneous costs and special data, and practice of estimating. The appendices supplement the first part of the book and give methods and cost of pole-line and underground conduit work, collected from various sources. As giving methods and labor and material costs of individual jobs the appendices will be found distinctly helpful.

Forms and blanks for recording costs are given in each chapter as are the methods of computing, proportioning and pro-rating costs. The methods described and illustrated are the most recent standards of progressive telephone companies and the costs are averaged from actual cost records kept on many hundreds of jobs by specially trained men using a uniform system and working under the author's supervision. To illustrate, the costs of conduit work are averaged from actual costs kept on over 250,000 feet of underground conduit, laterals and on over 550 vaults. The costs of other classes of work are based on similarly extensive records.

Moreover, these costs are itemized and classified. In Chapter I, the cost tables not only give costs separately for each size and style of cross-arm, wire, anchor and each size of pole set in each kind of soil, but, in addition, give costs of each detail of construction work such as—in the case of poles—cost of teaming, of framing, of excavating, of setting, and of supervision. The cost tables in Chapter V give separately cost of each different conduit cross section for each different kind of soil, for various methods of constructing main conduit and laterals, and for each size and method of constructing vaults; and in addition, the cost of each detail of work, such as teaming, excavating, mixing concrete, laying tile, filling in, and supervision. Cost of the various kinds of splices are given in Chapter III. This classification and analysis is carried throughout every division of telephone construction.

NORTH CAROLINA ASSOCIATION MEETS.

THE third annual meeting of the Independent Telephone Association of North Carolina was held at High Point, N. C., August 12, the sessions being held in the rooms of the chamber of commerce. There were present a large number of representatives of the two hundred Independent telephone companies throughout North Carolina, this being the largest attendance in the history of the association. An all day session was held and many matters of importance were acted upon. The business of the association kept the representatives hard at work until a late hour, just finishing the work in time for some of the delegates to take the night trains for home.

At this meeting of the Independent companies very encouraging reports were made as to growth from every quarter. Many toll lines have been put up the past year and many more are now in course of erection or contemplated. The increase in the number of local telephones in the various towns and cities throughout the state is very gratifying. The Independent companies now have a perfect net work of telephone systems throughout the state, reaching practically every point of importance. It was shown at this meeting that from eighty-five to ninety-five per cent of the telephone business is done within a radius of from twenty to fifty miles from where it originates, and over seventy-five per cent in the cities and towns where the service is installed; there being only a small percentage of long distance service outside of these limits.

The association numbers among its membership some of the most influential men of the state in all walks of life who are very enthusiastic for the Independent companies. The officers of the association elected for the ensuing year are: President, W. A. Wynne, Raleigh; vice president, Mayor H. P. Grier, Statesville; secretary and treasurer, B. W. Leavitt, Southern Pines; executive committee: W. A. Wynne, Raleigh; J. B. Morris, Roxboro; H. P. Grier, Statesville; H. P. Stevenson, Smithfield; J. F. Hayden, High Point.

Indians of the Couer d'Alene reservation have organized a farmer telephone line of their own.

In The Rural Line Districts

The central office of the Lanark Mutual Telephone Company is being treated to a new cork carpet.—*Polo (Ill.) Press.*

It is reported that a Mutual telephone company is being organized at Cawker City. In the words of the small boy, "That's the stuff."—*Mankato (Kas.) Advocate.*

Harry Love, with the Home Telephone Company of Joplin, was among the visitors in the city yesterday, the guest of his wife and other relatives.—*Pittsburg (Kas.) Headlight.*

There is a new telephone line being built from Atwater to this place and it is known as the "Punkin" line. Neighbors are of the opinion that there will be some pumpkins along the line.—*Zanesville Correspondence, Litchfield (Ill.) Monitor.*

The telephone line has been down this week but we are sure the wind didn't blow it down. Some "snipe sucker" lit his snipe under it and the suction was so great that above results followed.—*Armsville Correspondence, Dyersburg (Tenn.) Herald.*

Moses Miller, of Bellows Falls, claims to be the discoverer of the telephone, when at the age of four years in company with his father it was found that the scratching at the end of the log could be heard distinctly by one at the other end. The tin can and waxed string experiment followed closely after. Besides this distinction he is relied on extensively as a weather prophet.—*Montpelier (Vt.) Argus.*

Our telephone line is taking in more territory. This time the line has been extended south taking in Robert Shaw and father, also an addition northeast taking in Martin Wernsman.—*Mabel Correspondence, Cameron (Mo.) Observer.*

Mr. Redmond has bought Mr. Van Dusen's interest in the Farmers' Union Telephone Company's line and has moved the telephone to his home where he says he can talk to his neighbors as well as anybody.—*Farmers' Union Correspondence, Jasper (Mo.) News.*

It is interesting to know that the Telephone company maintains a department for the rescue of cats which climb its poles and are unable or afraid to come down. The scheme is one of the most interesting of the many complex features of our modern life.—*Lowell (Mass.) Telegram.*

The Central Telephone Exchange boys were working in the neighborhood of A. U. Dodge's Tuesday and at noon were pleasantly surprised by Mr. Dodge appearing with hot coffee and several pies. The boys greatly appreciated the treat and wish to return their heartiest thanks for the same.—*Malta (Ill.) Record.*

The operators of the M. W. & O. Telephone Company have a club. At their last annual meeting last Valentine's day they decided to present to their manager some token of their appreciation. The gift decided upon was an alligator skin traveling bag. This was formally presented to him with the following appropriate verse:

On our annual meeting last Valentine Day,
A motion was made and carried our respects to pay,
So a committee was appointed to make it a go.
To our dandy, jolly, good manager of the M. W. & O.
As we all knew he enjoyed a nice little trip,
We thought nothing would suit better than an alligator grip,
And these hot summer days while traveling, as one loves to unstrip,
Then is when he will appreciate this handy and roomy alligator grip.

The manager was greatly moved by the evidence of esteem.—*Millersburg (O.) Mail.*

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